UNIVERSITY OF NEVADA, LAS VEGAS

Program Review Self-Study

Program Reviewed: Mathematics

Degrees: BA, BS, MS, PHD

Program Chair or Director: Zhijian Wu

Dean: Tim Porter

Date of Report: November 25th, 2015

*

GENERAL INSTRUCTIONS

1. Please provide Faculty CVs as a single electronic file (PDF preferred) or on a CD.
2. **Please complete the program review self-study using this template**.
3. If this review is covering several degree levels, please be sure to address ***each level*** in your responses to the questions.
4. Contacts for questions:
    a. Chair of the Faculty Senate Program Review Committee: Bill Robinson, bill.robinson@unlv.edu, 702-895-3769.
    b. Director for Accreditation & Special Projects in the Office of the Vice Provost for Academic Affairs: Gail Griffin, gail.griffin@unlv.edu, 702-895-0482.

I. PROGRAM DESCRIPTION

A. College/Department/Program
   1. College or School: Science
   2. Unit: Mathematical Sciences Web address: http://www.unlv.edu/math
   3. Program(s) being reviewed: BA, BS, MS, Ph.D.

a. Degrees and their abbreviations: BA, BS, MS, Ph.D.

B. Primary individual completing this worksheet
   1. Name: Arthur Baragar
   2. Title: Associate Chair
   3. Date of self-study: 11/25/2015
   4. Campus Phone: 5-0378
   5. Mail Stop: 4020
   6. E-mail: baragar@unlv.nevada.edu
   7. Fax Number: 5-4343

C. Other faculty involved in writing this report: Derrick DuBose, Zhijian Wu, [Pat Pablo -- admin].

D. Please insert the most recent catalog description(s) of the program(s):

BA: The Bachelor of Arts in mathematics is designed to include a large level of flexibility to serve students in a variety of areas in mathematics and statistics: pure math, computational math, applied math, and statistics. The degree requires students to take a one-semester course in the following standard areas: Real Analysis, Algebra, Differential Equations, and Statistics. To ensure students have an appropriate level of breadth, 12 additional 400-level Department of Mathematical Sciences (DMS) courses are required. To ensure students have an appropriate level of depth, two (2) one-year sequences must be included. Also required are the standard courses at the freshman and sophomore level such as calculus and linear algebra. The DMS courses required for this degree are identical to the Bachelor of Science. The Bachelor of Science has more stringent course requirements than the Bachelor of Arts with regards to non-DMS required courses.

BS: The Bachelor of Sciences in Mathematics is designed to include a large level of flexibility to serve students in a variety of areas in mathematics and statistics: pure math, computational math, applied math, and statistics. The degree requires students to take a one-semester course in the following standard areas: Real Analysis, Algebra, Differential Equations, and Statistics. To ensure students have an appropriate level of breadth, 12 additional 400-level Department of Mathematics courses are required. To ensure students have an appropriate level of depth, two (2) one-year sequences must be included. The standard freshman and sophomore level courses are also required, such as calculus and linear algebra.

We also have a BS in mathematics with a concentration in Actuarial Sciences. The data for the BS in mathematics presented in this report includes those students in the Actuarial Sciences concentration.

MS: The degree is a well-established MS program with concentrations in Applied Math, Pure Math, Statistics, and Math Education to serve students in many different areas of Mathematical Sciences. The concentrations in pure, applied, and statistics each include a core requirement corresponding to the given area. Additional credits are required so that students can develop knowledge in a field of interest. All three require the student to either defend a thesis or pass a written comprehensive exam corresponding to the core requirements. The teaching mathematics concentration requires a variety of content courses, as well as, education courses. The degree options for the teaching math concentration include the opportunity to write a professional paper.

PhD: UNLV's Mathematical Sciences Ph.D. program is Nevada's only Ph.D. program in the Mathematical Sciences. It is relatively new (established in 2005) and includes concentrations in Applied Math, Pure Math, Computational Math, and Statistics to serve students in many different areas of Mathematical Sciences. The main part of the Ph.D. is the dissertation. The degree requirements also include: credit requirement, qualifying examination requirement, subject area breadth requirement. The qualifying examination requirement and the subject area breadth requirement are tailored according to the area of concentration.

There are also program descriptions for dual degrees: MA Economics/MS Math; PhD Electrical Engineering/MS Math; and MS Electrical Engineering/MS Math.

1. Is the description correct? If not, what needs to be changed?

The descriptions are correct.

2. What additions, corrections, or other changes have been made to the program since the catalog was published?

None.

II. MISSION and GOALS

A. Department/Program Mission

What is the program's mission statement (or the department's if the program does not have one)?

The mission of the Department of Mathematical Sciences is to serve the public through teaching, research, and service. In particular, the Department:

- Fosters a supportive atmosphere while providing comprehensive mathematics and statistics education at both the graduate and undergraduate level.
- Nurtures research in the mathematical sciences, contributing to humankind's understanding and facilitating current and future scientific advances.
- Supports the application of mathematics and statistics, and the improvement of mathematics education, in order to address the needs of the local, regional, and national communities.

The Department of Mathematical Sciences is strongly committed to becoming a world-recognized center of excellence in teaching, research, and service. Principal goals include placing in the top 100 mathematics graduate programs nationally including the efficient transition of our matriculating students and improving student performance and retention in the Department's service courses.

B. Department/Program Mission Alignment

Briefly describe how this program is aligned to the mission of the University as described in the most recent mission statement, UNLV Mission http://unlv.edu/about/mission-statement:

As one would imagine, given the central importance of mathematics in any university, our mission is aligned with the University's mission. Of particular note are our high expectations of our students, and how mathematics empowers students, whether in research or daily life.

Not said in the University's mission is our current objective of becoming a Top Tier university. Our goal to be recognized among the top 100 graduate programs is consistent with the University's goal.

C. Core Themes

Briefly describe how this program supports UNLV's Core Themes (the core themes can be found at http://unlv.edu/about/mission-statement:

Our programs all promote student learning and success; our graduate program in particular advances research and creative activity; and our programs engage the community, particularly (but not exclusively) through our training of future high school mathematics teachers.

III. NEED/DEMAND FOR PROGRAM

A. *Stakeholders*

1. Who are the local and regional stakeholders of your educational programs, i.e., employers and entities benefiting from these programs, hiring the graduates, or admitting them to graduate and/or professional programs?

A recent ranking of careers placed mathematician at the top (http://www.careercast.com/jobs-rated/jobs-rated-2014-ranking-200-jobs-best-worst) and included statistician and actuary in the top five. The accompanying report remarked that "… the field's versatility is a primary reason it outscored the competition …." Mathematicians are trained to think logically and analytically, and employers recognize and covet those skills. The same report projected a growth rate for the field of 23% through 2022. (It was not clear whether those projections were from CareerCast or the US Bureau of Labor Statistics.)

Consequently, our stakeholders are diverse. We have observed graduates placed in education (e.g. the Nevada State College, the Clark County School District, and the College of Southern Nevada), the gaming industry, and various smaller industries (e.g. imaging, 3-D printing). Graduates of our Actuary concentration regularly secure meaningful employment.

UNLV itself is a huge stakeholder, as almost all of our lower level math courses are taught by our graduate students (25% of SCH) or part time instructors (34%). Most of our part time instructors are our alumni or current graduate students. The Math Learning Center teaches all non-credit remedial math courses MATH 095 and 096.

2. What are specific stakeholder needs for graduates?

Unlike a professional or vocational school, the idea behind a liberal education (see our University's mission) is that we are empowering our students with the ability and flexibility to adapt to a wide range of career options. While some of our courses may be of particular interest to future employers (e.g. statistics, actuarial sciences, calculus, differential equations, number theory), the fundamental skills our stakeholders seek are the ability to think creatively, logically, and analytically.

B. ***Enrollment***

1. Below is headcount, course enrollment, and degrees conferred data from Decision Support (formerly Institutional Analysis & Planning).

Academic Level Key

Undergraduate (UGRD):	Graduate (GRAD):
10 – Freshman	GR - Graduate
20 – Sophomore	PHD – PhD
30 – Junior	
40 – Senior	
50 – Post Bacc Undergrad	

		Headcount							
Major Description	**Academic Level - Beginning of Term**	**Fall 2010 Prelim**	**Spring 2011 Prelim**	**Fall 2011 Prelim**	**Spring 2012 Prelim**	**Fall 2012 Prelim**	**Spring 2013 Prelim**	**Fall 2013 Prelim**	**Spring 2014 Prelim**
Mathematics BA	10	2	1	2	1	1	2	4	3
	20	3	3	4	3	3	1		1
	30	7	5	3	3	5	4	8	5
	40	11	15	18	19	14	10	16	14
	50			4	3	2	2	2	1
Mathematics BS	10	19	15	10	11	19	14	23	12
	20	10	8	12	13	17	18	19	16
	30	21	18	16	15	18	27	29	28
	40	51	49	42	30	44	44	46	50
	50			7	4	3	4	6	6
Mathematical Sciences MS	GR	34	30	26	31	34	31	36	32
	PHD					1	1	1	1
Mathematical Sciences PHD	GR	1							
	PHD	26	26	25	23	24	25	28	26

		Enrollment Count							
Subject	**Course Number Level**	**Fall 2010 Prelim**	**Spring 2011 Prelim**	**Fall 2011 Prelim**	**Spring 2012 Prelim**	**Fall 2012 Prelim**	**Spring 2013 Prelim**	**Fall 2013 Prelim**	**Spring 2014 Prelim**
HON	100-Level	23							
MAT	600-Level	34	42	16	32	29	28	25	30
	700-Level	86	59	81	66	70	56	85	56

MATH	100-Level	3,405	2,636	3,439	2,669	3,622	2,888	4,582	3,205
	200-Level	259	229	198	193	188	199	224	247
	300-Level	88	117	79	144	82	134	106	177
	400-Level	245	210	264	237	270	194	238	229
	95	798	595	1,005	501	1,067	440	1,008	450
	96	584	604	674	767	716	733	701	739
SCI	600-Level		11	38	64	13	50	12	38
STA	600-Level	11	7	6	3	12	11	10	4
	700-Level	43	35	46	28	22	34	31	23
STAT	100-Level	43	24			25	30	25	32
	300-Level	121	88	95	100	119	79	94	100
	400-Level	147	116	114	122	113	131	127	144

Mathematical Sciences

Degrees conferred

Academic Plan Description	Degree	Degree Description	Academic Year - July to June	Degree Count
Mathematical Sciences MS	MS	Master of Science	2008-09	4
			2009-10	4
			2010-11	10
			2011-12	15
			2012-13	6
			2013-14	10
Mathematical Sciences PHD	PHD	Doctor of Philosophy	2008-09	2
			2009-10	1
			2010-11	2
			2011-12	1
			2012-13	1
			2013-14	1
Mathematics BA	BA	Bachelor of Arts	2008-09	1
			2009-10	2
			2010-11	3
			2011-12	6
			2012-13	5

			2013-14	6
Mathematics BS	BS	Bachelor of Science	2008-09	9
			2009-10	13
			2010-11	22
			2011-12	9
			2012-13	11
			2013-14	16

2. Discuss the headcounts from the last five years, i.e., are the trends in line with projections in your unit's strategic plan?

The headcount for the undergraduate majors has been fairly stable, with a bump up for the 2011 graduating class. We have supported the undergraduate program by sponsoring a chapter of Pi Mu Epsilon and later giving them some space. Activity in the club waxes and wanes, but the class of 2011 was particularly active. It is not clear to us which was cause and effect: Did the larger class create a more active club? Or did an active club have the effect of recruiting students to the discipline? In any case, fostering discipline related student social clubs helps the program and we hope to continue to do our part.

The graduate head count is the one we are most proud of. Our Ph.D. program began in 2005, so over the past ten years, that number has gone from zero to a respectable (and stable?) number in the upper 20's. What is not shown in this data is the improvement in the quality of graduate student in our programs, another trend that we are proud of.

The head count that we are most concerned about is at the 100 level, where enrollment has shot up from 6000 students in 2010-2011 to 7700 students in 2013-2014. That is an increase of 1700 students, which at 40 students per class, is an increase of 43 classes, or 10+ instructors. The success of our graduate program partially absorbed this impact, but classes taught by graduate students has increased from an average of 37 students per class in 2006 to the current 49 students per class. We cannot continue to increase the size of classes, as physical space (the size of classrooms) restricts that. In 2006, we hired six much needed new faculty. Since then, we have lost 3 regular faculty (Aizley, Kern, Westveld), hired two (Jaynes, Wu), and hired one Faculty in Residence (Savatorova). One faculty member is currently working at a reduced rate (Catlin, at 51%), and another is on leave without pay (Jaynes). We also have two visiting positions (Fall 2015, McGinn and Zhou). There is also another entity on campus, the Math Learning Center, that has hired three FIR's to teach non-credit remedial math courses. Their student enrollment numbers are included in the above data under MATH 95 and 96. The Honors College has also hired an FIR to teach their math classes.

Headcount goals have never been an issue we have thought worth considering, so there are no projections to compare to. The exception is the Ph.D. program, which had plenty of detractors within the department, but whose success has won many of them over and has exceeded almost everyone's expectations.

3. If not, why not?

4. Does your program's enrollment trend differ from national trends?
About 0.45% of all bachelor's degrees at UNLV are awarded in the mathematical sciences. This is lower than the national trend, which is 0.9% -- 1.0% of all degrees. (From "Science and Engineering Indicators 2012," National Science Foundation, http://www.nsf.gov/statistics/seind12/c2/c2s2.htm.)

About 0.9% of all master's degrees conferred at UNLV are in the mathematical sciences, while about 1% of all Ph.D. degrees are in the mathematical sciences.

5. If yes, please discuss the reasons:
The high rates in the graduate programs are likely due to our recruiting efforts. The undergraduate rate is likely an artifact of college entrance metrics and the scholastic demographics at UNLV. Aptitude in mathematics is

one of the two metrics most commonly used to make admissions decisions, so students with an aptitude in mathematics are more likely to have a choice of institutions to attend. More than half of UNLV's entering undergraduates must take remedial (no college credit) math courses. In this respect, UNLV is an outlier, as no Top Tier university has more than a third of their students place into remedial math courses.

Another reason may be our building. Image matters to students, and they correlate the building appearance with the value of the programs (mathematics and statistics) housed in it. We are housed in the old temporary buildings often referred to as trailers by students (https://www.unlv.edu/maps/cdc-8), though they are not quite that bad. This may affect our ability to attract students, particularly since the students who consider mathematics as a major are likely also contemplating career choices in physics (https://www.unlv.edu/maps/bpb) and computer science (https://www.unlv.edu/maps/tbe-a).

C. ***Graduation Rates***

Program graduation numbers and rates are summarized below.

First-time, Full-time Freshmen Graduating within Six Years

Fall 2000 - Fall 2007 Cohorts

Cohort		Graduated			
Term	Number	in Department	%	any Department	%
Fall 2000	7	4	57.1%	4	57.1%
Fall 2001	9	0	0.0%	3	33.3%
Fall 2002	6	1	16.7%	3	50.0%
Fall 2003	16	2	12.5%	4	25.0%
Fall 2004	10	1	10.0%	4	40.0%
Fall 2005	12	1	8.3%	4	33.3%
Fall 2006	16	2	12.5%	8	50.0%
Fall 2007	11	2	18.2%	5	45.5%
Combined Cohort	*87*	*13*	*14.9%*	*35*	*40.2%*

First-year Retention of First-time, Full-time Freshmen (excludes transfers)

Fall 2010- Fall 2012 Cohorts

Cohort		Retained to Next Fall	
Term	Number	#	%
Fall 2010	10	7	70.0%
Fall 2011	9	8	88.9%
Fall 2012	10	6	60.0%
Combined Cohort	*29*	*21*	*72.4%*

First-year Retention of Full-time, New Undergraduate Transfers

Fall 2010- Fall 2012 Cohorts

Cohort		Retained to Next Fall	
Term	Number	#	%
Fall 2010	7	6	85.7%
Fall 2011	5	3	60.0%
Fall 2012	8	7	87.5%
Combined Cohort	*20*	*16*	*80.0%*

Notes: Acad_Plans in MATBA, MATBS, MATMS, MATPHD

Source: MyUNLV Analytics Student Tracking data mart – Preliminary

New Masters Students Graduating in Less than Six Years

Fall 2005 - Fall 2011 Cohorts

Cohort		Graduated in...							
Term	Number	2 Years	%	3 Years	%	4 Years	%	5 Years	%
Fall 2005	7	1	14.3%	3	42.9%	3	42.9%	3	42.9%
Fall 2006	6	2	33.3%	2	33.3%	2	33.3%	2	33.3%
Fall 2007	2	1	50.0%	2	100.0%	2	100.0%	2	100.0%
Fall 2008	12	1	8.3%	8	66.7%	9	75.0%	9	75.0%
Fall 2009	8	1	12.5%	3	37.5%	3	37.5%	*16/27*	*59.3%*
Fall 2010	6	2	33.3%	3	50.0%	*19/35*	*54.3%*		
Fall 2011	9	1	11.1%	*21/41*	*51.2%*				
Combined Cohort		*9/50*	*18.0%*						

New Doctoral Students Graduating within Eight Years*

Fall 2001 - Fall 2010 Cohorts

Cohort		Graduated in...											
Term	Number	3 Years	%	4 Years	%	5 Years	%	6 Years	%	7 Years	%	8 Years	%
Fall 2001	0	-	-	-	-	-	-	-	-	-	-	-	-
Fall 2002	0	-	-	-	-	-	-	-	-	-	-	-	-
Fall 2003	0	-	-	-	-	-	-	-	-	-	-	-	-
Fall 2004	0	-	-	-	-	-	-	-	-	-	-	-	-
Fall 2005	4	0	0.0%	1	25.0%	1	25.0%	2	50.0%	2	50.0%	2	50.0%
Fall 2006	4	0	0.0%	0	0.0%	0	0.0%	1	25.0%	1	25.0%	*2/4*	*50.0%*
Fall 2007	3	0	0.0%	1	33.3%	1	33.3%	1	33.3%	*3/8*	*37.5%*		
Fall 2008	10	0	0.0%	0	0.0%	1	10.0%	*4/11*	*36.4%*				

Fall 2009	4	0	0.0%	0	0.0%	*3/21*	*14.3%*
Fall 2010	6	0	0.0%	*2/25*	*8.0%*		
Combined Cohort		*0/31*	*0.0%*				

*Doctoral graduation rates may include both masters and doctoral degree conferrals.

Using the data in the tables above, please answer these questions:

1. Are trends in 6-year cohort graduation close to the University's goal (UNLV's undergrad goal is 50%)?

   Our cohort 6yr graduation rate is 40%. Despite the proximity with UNLV's number, whose 6yr graduation rate is 39% (https://ir.unlv.edu/IAP/Files/CDS_B._Enrollment_and_Persistence_2014-15.aspx), this number may not be an accurate representation of the success of our program. There were 71 students in the cohort, yet six years later, 103 degrees in mathematics were conferred (numbers are for a five year interval; see #3 below for more detail). Most of our students transfer into the major after they begin their studies. This is quite understandable, since students fresh out of high school rarely understand what it means to be a math major. The calculus sequence is probably the filter, repelling students for whom mathematics is not a good fit, and attracting students (e.g. from physics and engineering) to the beauty of mathematics. We also hear that there exist students who declare math as their major just because they have to declare a major but do not qualify for their chosen field. Nevertheless, we have instituted a policy that we hope will make this rate more meaningful in the future (please see #2 below).

   This situation should not be viewed as a big problem, as most students who discover that math is not a good fit are likely enlightened while taking courses that are still required of their eventual major (e.g. another STEM field), and those for whom math was not their freshman calling likely discover the beauty while fulfilling requirements for another field that coincidently has kept them on track for a math degree. Math majors share math courses with many disciplines, and do not take courses tailored specifically for them until they reach their senior level courses.

   The 5yr graduation rate at the Masters level is almost 60%, so presumably is on target. The 3yr graduation rate at the Masters level is a healthy 51%.

   We are proud of our very young Ph.D. program, which already produces 1% of all Ph.D.'s awarded by UNLV.

2. If not, what is being done to reach the goal?

   Our department requires a student to qualify to enter Calculus I (MATH 181) before they can declare mathematics as their major. This is new in this year's catalog and we are currently working on making sure it is implemented. We felt this was an appropriate way of emphasizing to high school students what our expectations are. Our hope is that more students will recognize that an aspiring math major should complete pre-calculus while still in high school. We also felt we were conveying the message that to be on track to finish a degree in mathematics within four years, a student should be ready to take Calculus I as a freshman.

3. Discuss how and why the graduation rate is changing.

   The graduation rate is all over the place, varying from 25% to 57%. This is because the numbers are small and because of the reasons mentioned above. For example, the 2007 cohort had only two of 11 students remain within the department, but in 2014 (six years later), we had 22 students earn bachelor degrees. The combined cohort for six years (2002 – 2007) is 71 of which only 13 stayed in the department, but our graduates over six years (2009 – 2014) numbered 103. Most of our majors (87%) transfer into the discipline. The cohort information is misleading.

D. ***Needs for Graduates and Future Plans***

1. What are the anticipated needs for program graduates over the next 3-5 years? Please cite sources of information.

If we believe CareerCast (http://www.careercast.com/jobs-rated/jobs-rated-2014-ranking-200-jobs-best-worst), the need for mathematicians will steadily increase (growth of 23% through 2022).

The growth rate of UNLV has been more dramatic (see that 28% increase in 100 level student enrollment over three years). This means UNLV's internal needs (more graduate assistants to teach these courses) are relying on growth of the graduate program, and therefore also the growth of our regular faculty (tenure/tenure-track).

2. What changes to the program will those require?

Let us first address what is needed now. Over the past four years, regular faculty has remained stable at 29. The number of GA's has increased by 10% to 44. Those two constituencies teach, on average, 12,000 student credit hours (SCH) per fall semester. The load, though, has increased by 10,000 SCH, from just shy of 14,000 SCH in Fall 2011, to just shy of 24,000 SCH in fall 2014. The increased load was covered by part time instructors (PTI), and a new class of faculty called Faculty in Residence (FIR). An FIR is a non-tenure-track teaching faculty with an indefinite renewable contract. The math department hired an FIR in Fall 2014. The Math Learning Center hired three FIR's. The FIR load went from 0 in 2011 to 2600 SCH in 2014. The PTI load went from 2200 to 8100 SCH. Our PTI pool is limited and pretty much exhausted. There are no more qualified individuals in Las Vegas. Our department is at a breaking point. We are in desperate need of resources.

We note that in 1998 (the year of our last external review), the reviewers recommended that we hire 10-12 new faculty in the next five years (by 2004), as well as replace any faculty lost during that time. In 1998, we had 25.5 faculty. Today, 17 years later, we have 30 faculty, a net gain of 4.5 positions. That committee also remarked "Even the ambitious hiring program described above is unlikely to keep pace with increases in the instructional responsibilities of the Department." They went on to recommend 3 to 5 visiting positions, whose teaching load would be similar to that of an FIR. We have one FIR and two visiting positions with high teaching loads.

Our first goal should be to decrease our reliance on PTI's. In Fall 2014, PTI's taught 84 credits, the equivalent of 14 instructors. Our GA's teach 6 credits per semester, roughly the same as regular faculty (though lower level courses and fewer preparations). Figuring a 3:2 GA-to-Faculty ratio, we need 9 new GA's and 6 new faculty.

Our second goal should be to reduce the GA teaching load from 49 students per class to 25 students per class. That would require instructors to cover an additional 4500 SCH, which translates to roughly 6 GA's and 4 faculty.

Future goals should include reducing the GA teaching load from 2 classes per semester to 3 per year.

In summary, to adequately deal with our current situation, we need 15 new GA's (assuming we can fill them) and 10 new regular faculty. Currently, some sections of Calculus I are being taught by PTI's, which is deplorable.

How should we factor in projected growth? Over the last four years, UNLV grew at a rate of 8.5%/yr (using the 100 level courses as an indicator). At that rate, we should be adding faculty at a rate of 3 to 4 new faculty per year; more precisely, 20 new faculty in the next three years, 30 in the next five years. UNLV cannot sustain such a growth rate. If we believe a more modest 3% per year, we are looking at 16 new faculty in five years.

3. What would be the total estimated costs for these changes?

Sixteen new faculty in five years. Twenty-four new GA's. Space for them. Former President Smatrask used to say a new line was roughly a $3,000,000 commitment, so $48 million? Figuring salary and benefits of around $100,000/yr per hire, $1.6 million per year plus a new building?

E. ***Placement of Graduates***

1. Discuss the placements of recent graduates:

Ph.D. students:

- Two are in tenure-track positions (Western Michigan and U Tennessee at Chattanooga)
- Two work for engineering firms (California and China)
- One is a PTI in Chicago (followed a spouse, so employment opportunities were geographically limited)
- One has a research fellowship in the College of Engineering here at UNLV
- Several work for our math department (visiting instructors, PTI)
- One works for the College of Southern Nevada.

Masters students:

- Several work for Konami here in Las Vegas
- Several work at casinos here in Las Vegas
- Several work for gaming companies (software development) here in Las Vegas
- Several teach in the Clark County School District, at the College of Southern Nevada, at the Nevada State College, or here at UNLV as PTI's
- Several have continued their graduate studies at other universities
- Zappos, banking, imaging (airport cargo scanner designs), 3D printing

Undergraduate: Very little is known.

2. If the department or program does not have placement information on graduates, what is the plan to implement gathering that information?
   We have not yet formulated a plan to follow our students. Past attempts have produced partial lists.

3. Do placements match stakeholder needs as identified above in A of this section?
   Many of the placements for our graduate students suit their education.

IV. QUALITY OF PROGRAM and STUDENT OUTCOMES

A. *Admission and graduation requirements*

1. Please insert program admission requirements from the current UNLV catalog:

   Bachelors (BA & BS): Minimum GPA: 2.50 and placement into MATH 181 - Calculus I or higher.

   Masters: Admission requirements of the Graduate College; 18 credit hours of upper-level math courses beyond calculus; An undergraduate GPA of at least 2.75; International students for whom English is not their country's official language must have a TOEFL score of 79 for the IBT, 213 for the computer test, or 550 for the paper test.

   Ph.D.: For those with an MS, at least a 3.0 GPA and 15 credit hours of graduate level math courses with a B or above; For those without an MS, an undergraduate GPA of 3.0 or 3.25 in the last two years of mathematics work; A GRE score of 700 or better on the quantitative part, and a combined score of 1100 in verbal and quantitative; International students for whom English is not their country's official language must have a TOEFL score of 79 for the IBT, 213 for the computer test, or 550 for the paper test.

2. What additions, corrections, or other changes have been made to admissions requirements since the catalog was issued?

   None.

3. How many full-time advisors are available at the college level?

   Six. Advising is done by the college, as is noted in the question. This is a potential area of improvement, though like everything else, it requires resources.

4. Are admissions requirements and advising sufficient to make sure that the students are adequately prepared for the introductory major courses?

No. Students who have not met the requirements are still being let into the program. (This is at the admissions level, not the advising level.)

5. If not, what are the reasons and what is being done to correct the issue(s):

   Admissions has been informed and they are working on it.

6. Insert the graduation requirements from the current catalog:

Bachelor of Arts: Mathematical Science Degree Requirements - Total: 120 Credits (see note 1 below)

General Education Requirements - Subtotal: 33-36 Credits

First-Year Seminar - Credits: 2-3 (see note 2 below)
English Composition - Credits: 6

- ENG 101 - Composition I
- ENG 102 - Composition II

Second-Year Seminar - Credits: 3
Constitutions - Credits: 4-6
Mathematics
Distribution Requirements - Credits: 18 (Please see Distribution Requirements for more information.)

- **Humanities and Fine Arts: 9 credits**
  - Two 3-credit courses in the humanities and one 3-credit course in fine arts.
- **Social Science: 9 credits**
  - One course each from three different fields
- **Life and Physical Sciences and Analytical Thinking :**
  - Automatically satisfied by Major requirements

Multicultural and International

- Multicultural, one 3 credit course required
- International, one 3 credit course required
  - These courses may overlap with general education and major requirements. A single course may not meet the multicultural and international requirements simultaneously. For the list of approved multicultural and international courses, go to: http://facultysenate.unlv.edu/students.

Major Requirements - BA in Mathematical Science - Subtotal: 51 Credits

- **Computer Programming Requirements - Credits: 3 Select one of:**
  - CS 117 - Programming for Scientists and Engineers or CS 135 - Computer Science I
- **Science Requirements - Credits: 9**
  - Select nine (9) credits, including a LAB course, from college-level BIOL, CHEM, GEOG, GEOL, PHYS, CEE, CS, CpE, EE, ME courses.
- MATH 181 - Calculus I - Fulfills Math General Education Requirement
- MATH 182 - Calculus II
- MATH 251 - Discrete Mathematics I
- MATH 283 - Calculus III
- MATH 330 - Linear Algebra or MATH 365 - Computational Linear Algebra
- MATH 427 - Differential Equations I
- MATH 453 - Abstract Algebra I
- MATH 457 - Introduction to Real Analysis I
- and 12 additional credits from 400-level MATH or STAT courses. The prog
  one-year 400-level MATH or STAT sequences.

Electives - Credits: 33-36
Total Credits: 120
Notes

1. Every student will be encouraged to take the GRE Advanced Test in Mathematics.
2. It is strongly recommended that students take SCI 101 to satisfy the First Year Seminar requirement.

Bachelor of Science: Mathematical Science Degree Requirements - Total: 120 Credits (see notes 1-2 below)
General Education Requirements - Subtotal: 33-36 Credits
First-Year Seminar - Credits: 2-3 (see note 3 below)
English Composition - Credits: 6

- ENG 101 - Composition I
- ENG 102 - Composition II

Second-Year Seminar - Credits: 3
Constitutions - Credits: 4-6
Mathematics
Distribution Requirement - Credits: 18 (Please see Distribution Requirements for more information.)

- **Humanities and Fine Arts: 9 Credits**
  - Two courses 3 credits each from two different humanities areas - 6 credits
  - One course in fine arts- 3 credits
- **Social Science: 9 Credits**
  - One course each from three different fields.
- **Life and Physical Sciences and Analytical Thinking:**
  - Automatically satisfied by Major requirements

Multicultural and International

- Multicultural, one 3 credit course required
- International, one 3 credit course required
  - These courses may overlap with general education and major requirements. A single course may not meet the multicultural and international requirements simultaneously. For the list of approved multicultural and international courses, go to: http://facultysenate.unlv.edu/students

Major Requirements - BS in Mathematical Science - Subtotal: 80 Credits

- **Computer Programming Requirements - Credits: 3**
  - CS 117 - Programming for Scientists and Engineers or CS 135 - Computer Science I

Science Requirements - Credits: 9

- PHYS 180 - Physics for Scientists and Engineers I
- PHYS 180L - Physics for Scientists and Engineers Lab I
- and select five credits from the following: BIOL courses numbered 189 and above; CHEM courses numbered 121 and above except CHEM 201, 203; GEOL courses numbered 220 and above; GEOG courses numbered 300 and above; PHYS courses numbered 181 and above; CEE courses numbered 241 and above; CS courses numbered 218 and above; CpE courses numbered 300 and above; EE courses numbered 220 and above; ME courses numbered 242 and above.

Required Department Courses - Credits: 39

- MATH 181 - Calculus I - fulfills Mathematics General Education Requirement
- MATH 182 - Calculus II
- MATH 251 - Discrete Mathematics I
- MATH 283 - Calculus III
- MATH 330 - Linear Algebra or MATH 365 - Computational Linear Algebra
- MATH 427 - Differential Equations I
- MATH 453 - Abstract Algebra I
- MATH 457 - Introduction to Real Analysis I
- and 12 additional credits from 400-level MATH or STAT courses. - The prog
  year 400-level MATH or STAT sequences.

Science and Engineering Electives - Credits: 29
Electives - Credits: 4-7
Total Credits: 120
Notes

1. Of the 120 credits required for graduation, 80 or more must be in courses offered by the College of Sciences and the College of Engineering.
2. Every student will be encouraged to take the GRE Advanced Test in Mathematics
3. It is strongly recommended that students take SCI 101 to satisfy the First Year Seminar requirement.

BS in Mathematics Actuarial Science Concentration - Subtotal: 63 Credits (see note 2 below)

Computer Programming Requirements - Credits: 3

Select one of:

- CS 117 - Programming for Scientists and Engineers
- CS 135 - Computer Science I

Science Requirements - Credits: 9

Select nine (9) credits, including a LAB course, from BIOL courses numbered 189 and above; CHEM courses numbered 121 and above except CHEM 201, 203; GEOL courses numbered 220 and above; GEOG courses numbered 300 and above: PHYS courses numbered 180 and above; CEE courses numbered 300 and above; CS courses numbered 218 and above; all CpE courses; EE courses numbered 220 and above; all ME courses.

Required Department Courses - Credits: 42

- MATH 181 - Calculus I
- MATH 182 - Calculus II
- MATH 283 - Calculus III
- MATH 320 - Mathematics of Interest
- MATH 330 - Linear Algebra or MATH 365 - Computational Linear Algebra
- MATH 463 - Advanced Matrix Theory and Applications or MATH 466 - Numerical Methods I
- MATH 427 - Differential Equations I
- MATH 471 - Actuarial Mathematics I
- MATH 472 - Actuarial Mathematics II
- STAT 411 - Statistical Methods I
- STAT 412 - Statistical Methods II
- STAT 467 - Introduction to Mathematical Statistics
- STAT 488 - Senior Research Project in Statistics

Economics and Finance Requirements

- ECON 102 - Principles of Microeconomics
- ECON 103 - Principles of Macroeconomics
- FIN 321 - Corporate Risk Management

Sciences and Engineering Electives - Credits: 6
Electives - Credits: 15-18
Total Credits: 120

Masters of Science:

Subplan 1 Requirements: Pure Mathematics - Thesis Track
Total Credits Required: 33
Course Requirements

- **Analysis Courses – Credits: 6.** Complete two of the following courses:
  - MAT 707 - Real Analysis I
  - MAT 708 - Real Analysis II
  - MAT 709 - Complex Function Theory I
  - MAT 710 - Complex Function Theory II
  - MAT 771 - Applied Analysis I
  - MAT 772 - Applied Analysis II
- **Algebra Course – Credits: 3.** Complete one of the following courses:
  - MAT 703 - Abstract Algebra III
  - MAT 704 - Abstract Algebra IV
  - MAT 753 - Homological Algebra
  - MAT 754 - Homological Algebra
  - MAT 755 - Topics in Algebra
- **Area of Emphasis Courses – Credits: 6.** Complete an additional 6 credits of 700-level MAT courses (excluding MAT 711 & 712) in a field of special interest.
- **Elective Courses – Credits: 12.** Complete 12 credits of 600- or 700-level MAT or STA courses (excluding

MAT 711 & 712), or other advisor-approved courses.

- **Thesis – Credits: 6**
  - MAT 791 - Thesis

Degree Requirements

- Students must complete a minimum of 33 credit hours with a minimum GPA of 3.00.
- Of the 33 required credits, 27 must be coursework. Of those 27 coursework credits, at least 18 must be 700-level.
- A student will be placed on academic probation if a minimum of 3.00 GPA is not maintained in all work taken in the degree program. A grade of C or less in one graduate-level course will cause a student to be placed on academic probation and will elicit a critical review of the student's program by the Graduate Studies Committee. Students who fail to meet the conditions of their probation will be separated.
- In consultation with his/her advisor, a student will organize a thesis committee of at least three departmental members. In addition, a fourth member from outside the department, known as the Graduate College Representative, must be appointed. An additional committee member may be added at the student and department's discretion. Please see Graduate College policy for committee appointment guidelines.

Graduation Requirements

- The student must submit all required forms to the Graduate College and then apply for graduation up to two semesters prior to completing his/her degree requirements.
- The student must submit and successfully defend his/her thesis by the posted deadline. The defense must be advertised and is open to the public.
- The student must submit his/her approved, properly formatted hard-copy thesis to the Graduate College, and submit the approved electronic version to ProQuest by the posted deadline.

Subplan 2 Requirements: Pure Mathematics - Comprehensive Exam Track

Total Credits Required: 30

Course Requirements

- **Analysis Courses – Credits: 6.** Complete two of the following courses:
  - MAT 707 - Real Analysis I
  - MAT 708 - Real Analysis II
  - MAT 709 - Complex Function Theory I
  - MAT 710 - Complex Function Theory II
  - MAT 771 - Applied Analysis I
  - MAT 772 - Applied Analysis II
- **Algebra Course – Credits: 3.** Complete one of the following courses:
  - MAT 703 - Abstract Algebra III
  - MAT 704 - Abstract Algebra IV
  - MAT 753 - Homological Algebra
  - MAT 754 - Homological Algebra
  - MAT 755 - Topics in Algebra
- **Area of Emphasis Courses – Credits: 6**
  - Complete an additional 6 credits of 700-level MAT courses (excluding MAT 711 & 712) in a field of special interest.
- **Elective Courses – Credits: 15**
  - Complete 15 credits of 600- or 700-level MAT or STA courses (excluding MAT 711 & 712), or other advisor-approved courses.
- Degree Requirements
  - Students must complete a minimum of 30 credit hours with a minimum GPA of 3.00.
  - Of the 30 required credits, at least 18 must be 700-level.
  - A student will be placed on academic probation if a minimum of 3.00 GPA is not maintained in all work taken in the degree program. A grade of C or less in one graduate-level course will cause a student to be placed on academic probation and will elicit a critical review of the student's program by the Graduate Studies Committee.
  - In consultation with his/her advisor, a student will organize an advisory committee of at least three departmental members. In addition, a fourth member from outside the department, known as the Graduate College Representative, must be appointed. An additional committee member may be added at the student and department's discretion. Please see Graduate College policy for committee appointment

guidelines.

Graduation Requirements

1. The student must submit all required forms to the Graduate College and then apply for graduation up to two semesters prior to completing his/her degree requirements.
2. The student must pass a final comprehensive examination.

Subplan 3 Requirements: Applied Mathematics - Thesis Track

Total Credits Required: 33

Course Requirements

- **Required Courses – Credits: 6.** Complete two of the following courses:
  - MAT 707 - Real Analysis I
  - MAT 708 - Real Analysis II
  - MAT 709 - Complex Function Theory I
  - MAT 710 - Complex Function Theory II
  - MAT 771 - Applied Analysis I
  - MAT 772 - Applied Analysis II
- **Numerical Analysis Course – Credits: 3.** Complete one of the following courses:
  - MAT 663 - Advanced Matrix Theory and Applications
  - MAT 765 - Advanced Numerical Analysis
  - MAT 767 - Topics in Numerical Analysis
- **Applied and Computational Courses – Credits: 6.** Complete 6 credits of 700-level advisor-approved MAT coursework in applied and computational mathematics.
- **Elective Courses – Credits: 9.** Complete 9 credits of 600- or 700-level MAT or STA courses (excluding MAT 711 & 712), or other advisor-approved courses.
- **Thesis – Credits: 6.** MAT 791 - Thesis

Degree Requirements

- Students must complete a minimum of 30 credit hours with a minimum GPA of 3.00.
- Of the 33 required credits, 27 must be coursework. Of those 27 coursework credits, at least 18 must be 700-level.
- A student will be placed on academic probation if a minimum of 3.00 GPA is not maintained in all work taken in the degree program. A grade of C or less in one graduate-level course will cause a student to be placed on academic probation and will elicit a critical review of the student's program by the Graduate Studies Committee.
- In consultation with his/her advisor, a student will organize a thesis committee of at least three departmental members. In addition, a fourth member from outside the department, known as the Graduate College Representative, must be appointed. An additional committee member may be added at the student and department's discretion. Please see Graduate College policy for committee appointment guidelines.

Graduation Requirements

1. The student must submit all required forms to the Graduate College and then apply for graduation up to two semesters prior to completing his/her degree requirements.
2. The student must submit and successfully defend his/her thesis by the posted deadline. The defense must be advertised and is open to the public.
3. The student must submit his/her approved, properly formatted hard-copy thesis to the Graduate College, and submit the approved electronic version to ProQuest by the posted deadline.

Subplan 4 Requirements: Applied Mathematics - Comprehensive Exam Track

Total Credits Required: 30

Course Requirements

- **Required Courses – Credits: 6.** Complete two of the following courses:
  - MAT 707 - Real Analysis I
  - MAT 708 - Real Analysis II
  - MAT 709 - Complex Function Theory I
  - MAT 710 - Complex Function Theory II
  - MAT 771 - Applied Analysis I
  - MAT 772 - Applied Analysis II
- **Numerical Analysis Course – Credits: 3.** Complete one of the following courses:
  - MAT 663 - Advanced Matrix Theory and Applications
  - MAT 765 - Advanced Numerical Analysis
  - MAT 767 - Topics in Numerical Analysis

- **Applied and Computational Courses – Credits: 6.** Complete 6 credits of 700-level advisor-approved MAT coursework in applied and computational mathematics.
- **Elective Courses – Credits: 15.** Complete 15 credits of 600- or 700-level MAT or STA courses (excluding MAT 711 & 712), or other advisor-approved courses.

Degree Requirements

1. Students must complete a minimum of 30 credit hours with a minimum GPA of 3.00.
2. Of the 30 required credits, at least 18 must be 700-level.
3. A student will be placed on academic probation if a minimum of 3.00 GPA is not maintained in all work taken in the degree program. A grade of C or less in one graduate-level course will cause a student to be placed on academic probation and will elicit a critical review of the student's program by the Graduate Studies Committee.
4. In consultation with his/her advisor, a student will organize an advisory committee of at least three departmental members. In addition, a fourth member from outside the department, known as the Graduate College Representative, must be appointed. An additional committee member may be added at the student and department's discretion. Please see Graduate College policy for committee appointment guidelines.

Graduation Requirements

1. The student must submit all required forms to the Graduate College and then apply for graduation up to two semesters prior to completing his/her degree requirements.
2. The student must successfully complete a final comprehensive examination.

Subplan 5 Requirements: Applied Statistics - Thesis Track

Total Credits Required: 33

Course Requirements

- **Required Courses – Credits: 6**
  - MAT 657 - Introduction to Real Analysis I
  - MAT 663 - Advanced Matrix Theory and Applications
- **Core Courses – Credits: 12**
  - STA 761 - Regression Analysis I
  - STA 762 - Regression Analysis II
  - STA 767 - Mathematical Statistics I
  - STA 768 - Mathematical Statistics II
- **Statistics Courses – Credits: 6.** Complete an additional 6 credits of 700-level STA coursework in a field of special interest to the student.
- **Elective Courses – Credits: 3.** Complete 3 credits of 600- or 700-level MAT or STA courses (excluding MAT 711 & 712), or other advisor-approved courses.
- **Thesis – Credits: 6.** MAT 791 - Thesis

Degree Requirements

1. Students must complete a minimum of 30 credit hours with a minimum GPA of 3.00.
2. Of the 33 required credits, 27 must be coursework. Of those 27 coursework credits, at least 18 must be 700-level.
3. A student will be placed on academic probation if a minimum of 3.00 GPA is not maintained in all work taken in the degree program. A grade of C or less in one graduate-level course will cause a student to be placed on academic probation and will elicit a critical review of the student's program by the Graduate Studies Committee.
4. In consultation with his/her advisor, a student will organize a thesis committee of at least three departmental members. In addition, a fourth member from outside the department, known as the Graduate College Representative, must be appointed. An additional committee member may be added at the student and department's discretion. Please see Graduate College policy for committee appointment guidelines.

Graduation Requirements

1. The student must submit all required forms to the Graduate College and then apply for graduation up to two semesters prior to completing his/her degree requirements.
2. The student must submit and successfully defend his/her thesis by the posted deadline. The defense must be advertised and is open to the public.
3. The student must submit his/her approved, properly formatted hard-copy thesis to the Graduate College, and submit the approved electronic version to ProQuest by the posted deadline.

Subplan 6 Requirements: Applied Statistics - Comprehensive Exam Track

Total Credits Required: 30

Course Requirements

- **Required Courses – Credits: 6**

  - MAT 657 - Introduction to Real Analysis I
  - MAT 663 - Advanced Matrix Theory and Applications
- **Core Courses – Credits: 12**
  - STA 761 - Regression Analysis I
  - STA 762 - Regression Analysis II
  - STA 767 - Mathematical Statistics I
  - STA 768 - Mathematical Statistics II
- **Statistics Courses – Credits: 6.** Complete an additional 6 credits of 700-level STA coursework in a field of special interest to the student.
- **Elective Courses – Credits: 6.** Complete 6 credits of 600- or 700-level MAT or STA courses (excluding MAT 711 & 712), or other advisor-approved courses.

Degree Requirements

1. Students must complete a minimum of 30 credit hours with a minimum GPA of 3.00.
2. Of the 30 required credits, 27 must be coursework. Of those 27 coursework credits, at least 18 must be 700-level.
3. A student will be placed on academic probation if a minimum of 3.00 GPA is not maintained in all work taken in the degree program. A grade of C or less in one graduate-level course will cause a student to be placed on academic probation and will elicit a critical review of the student's program by the Graduate Studies Committee.
4. In consultation with his/her advisor, a student will organize an advisory committee of at least three departmental members. In addition, a fourth member from outside the department, known as the Graduate College Representative, must be appointed. An additional committee member may be added at the student and department's discretion. Please see Graduate College policy for committee appointment guidelines.

Graduation Requirements

1. The student must submit all required forms to the Graduate College and then apply for graduation up to two semesters prior to completing his/her degree requirements.
2. The student must pass a final comprehensive examination.

Subplan 7 Requirements: Teaching Mathematics - Professional Paper Track

Total Credits Required: 30

Course Requirements

- **Required Courses – Credits: 9**
  - MAT 711 - Survey of Mathematical Problems I
  - MAT 712 - Survey of Mathematical Problems II
  - MAT 714 - History of Mathematics
- **Algebra Course – Credits: 3.** Complete one of the following courses:
  - MAT 653 - Abstract Algebra I
  - MAT 654 - Abstract Algebra II
  - MAT 703 - Abstract Algebra III
  - MAT 704 - Abstract Algebra IV
  - MAT 655 - Elementary Theory of Numbers I
  - MAT 669 - Combinatorics I
  - MAT 670 - Combinatorics II
- **Analysis Course – Credits: 3.** Complete one of the following courses:
  - MAT 657 - Introduction to Real Analysis I
  - MAT 658 - Introduction to Real Analysis II
  - MAT 707 - Real Analysis I
  - MAT 708 - Real Analysis II
  - MAT 659 - Elementary Complex Analysis
  - MAT 709 - Complex Function Theory I
  - MAT 710 - Complex Function Theory II
  - MAT 687 - Introduction to Partial Differential Equations
- **Foundations Course – Credits: 3.** Complete one of the following courses:
  - MAT 651 - Foundations of Mathematics I
  - MAT 652 - Foundations of Mathematics II
  - MAT 701 - Foundations of Mathematics III
  - MAT 702 - Foundations of Mathematics IV
  - MAT 680 - College Geometry

  - MAT 683 - General Topology I
  - MAT 684 - General Topology II
- **Education Courses – Credits: 6.** Complete two of the following courses:
  - CIS 622 - Instructional Middle School Mathematics Education
  - CIS 624 - Instruction Secondary Mathematics Education
  - CIG 620 - Principles of Learning Mathematics
- **Elective Courses – Credits: 3.** Complete 3 credits of 600- or 700-level MAT or STA courses, or other advisor-approved courses.
- **Professional Paper – Credits: 3**
  - MAT 793 - Teaching Concentration Professional Paper Research

Degree Requirements

1. Students must complete a minimum of 30 credit hours with a minimum GPA of 3.00.
2. Of the 30 required credits, 27 must be coursework. Of those 27 coursework credits, at least 15 must be 700-level.
3. A student will be placed on academic probation if a minimum of 3.00 GPA is not maintained in all work taken in the degree program. A grade of C or less in one graduate-level course will cause a student to be placed on academic probation and will elicit a critical review of the student's program by the Graduate Studies Committee.
4. In consultation with his/her advisor, a student will organize an advisory committee of at least three departmental members. In addition, a fourth member from outside the department, known as the Graduate College Representative, must be appointed. An additional committee member may be added at the student and department's discretion. Please see Graduate College policy for committee appointment guidelines.

Graduation Requirements

1. The student must submit all required forms to the Graduate College and then apply for graduation up to two semesters prior to completing his/her degree requirements.
2. The student must successfully complete and defend a professional paper.

Subplan 8 Requirements: Teaching Mathematics - Comprehensive Exam Track

Total Credits Required: 30

Course Requirements

- **Required Courses – Credits: 9**
  - MAT 711 - Survey of Mathematical Problems I
  - MAT 712 - Survey of Mathematical Problems II
  - MAT 714 - History of Mathematics
- **Algebra Course – Credits: 3.** Complete one of the following courses:
  - MAT 653 - Abstract Algebra I
  - MAT 654 - Abstract Algebra II
  - MAT 703 - Abstract Algebra III
  - MAT 704 - Abstract Algebra IV
  - MAT 655 - Elementary Theory of Numbers I
  - MAT 669 - Combinatorics I
  - MAT 670 - Combinatorics II
- **Analysis Course – Credits: 3.** Complete one of the following courses:
  - MAT 657 - Introduction to Real Analysis I
  - MAT 658 - Introduction to Real Analysis II
  - MAT 707 - Real Analysis I
  - MAT 708 - Real Analysis II
  - MAT 659 - Elementary Complex Analysis
  - MAT 709 - Complex Function Theory I
  - MAT 710 - Complex Function Theory II
  - MAT 687 - Introduction to Partial Differential Equations
- **Foundations Course – Credits: 3.** Complete one of the following courses:
  - MAT 651 - Foundations of Mathematics I
  - MAT 652 - Foundations of Mathematics II
  - MAT 701 - Foundations of Mathematics III
  - MAT 702 - Foundations of Mathematics IV
  - MAT 680 - College Geometry
  - MAT 683 - General Topology I

- MAT 684 - General Topology II

- **Education Courses – Credits: 6.** Complete two of the following courses:
  - CIS 622 - Instructional Middle School Mathematics Education
  - CIS 624 - Instruction Secondary Mathematics Education
  - CIG 620 - Principles of Learning Mathematics
- **Elective Courses – Credits: 6.** Complete 6 credits of 600- or 700-level MAT or STA courses, or other advisor-approved courses.

Degree Requirements

1. Students must complete a minimum of 30 credit hours with a minimum GPA of 3.00.
2. Of the 30 required credits, 27 must be coursework. Of those 27 coursework credits, at least 15 must be 700-level.
3. A student will be placed on academic probation if a minimum of 3.00 GPA is not maintained in all work taken in the degree program. A grade of C or less in one graduate-level course will cause a student to be placed on academic probation and will elicit a critical review of the student's program by the Graduate Studies Committee.
4. In consultation with his/her advisor, a student will organize an advisory committee of at least three departmental members. In addition, a fourth member from outside the department, known as the Graduate College Representative, must be appointed. An additional committee member may be added at the student and department's discretion. Please see Graduate College policy for committee appointment guidelines.

Graduation Requirements

1. The student must submit all required forms to the Graduate College and then apply for graduation up to two semesters prior to completing his/her degree requirements.
2. The student must pass a final comprehensive examination.

Doctor of Philosophy:
Subplan 1 Requirements: Post-Bachelor's - Applied Mathematics Track
Total Credits Required: 78
Course Requirements

- **Required Courses Part 1– Credits: 6.** Complete two analysis or two theory courses:
  - MAT 707 - Real Analysis I and MAT 708 - Real Analysis II

  OR
  - MAT 709 - Complex Function Theory I and MAT 710 - Complex Function Theory II
- **Required Courses Part 2 – Credits: 6**
  - MAT 771 - Applied Analysis I
  - MAT 772 - Applied Analysis II
- **Subject Area Courses – Credits: 12.** Complete two of the following one-year course sequences:
  - MAT 703 - Abstract Algebra III and MAT 704 - Abstract Algebra IV
  - MAT 723 - Advanced Ordinary Differential Equations I and MAT 724 - Advanced Ordinary Differential Equations II
  - MAT 729 - Partial Differential Equations I and MAT 730 - Partial Differential Equations II
  - MAT 733 – Topology and MAT 734 – Topology
  - MAT 765 - Advanced Numerical Analysis and MAT 766 - Advanced Numerical Analysis
  - STA 767 - Mathematical Statistics I and STA 768 - Mathematical Statistics II
- **Additional Courses – Credits: 12.** Complete 12 credits of 700-level MAT or STA courses (excluding MAT 711 & 712), or other advisor-approved courses.
- **Elective Courses – Credits: 24.** Complete 24 credits of 600- or 700-level MAT or STA courses (excluding MAT 711 & 712), or other advisor-approved courses.
- **Dissertation – Credits: 18**
  - MAT 799 - Dissertation

Degree Requirements: *See Plan Degree Requirements below.*
Graduation Requirements: *See Plan Graduation Requirements below.*
Subplan 2 Requirements: Post-Bachelor's - Computational Mathematics Track
Total Credits Required: 78
Course Requirements

- **Required Courses Part 1 – Credits: 6.** Complete two analysis or two theory courses:
  - MAT 707 - Real Analysis I and MAT 708 - Real Analysis II

  OR

  - MAT 709 - Complex Function Theory I and MAT 710 - Complex Function Theory II
- **Required Courses Part 2 – Credits: 6**
  - MAT 765 - Advanced Numerical Analysis
  - MAT 766 - Advanced Numerical Analysis
- **Subject Area Courses – Credits: 12**. Complete two of the following one-year course sequences:
  - MAT 703 - Abstract Algebra III and MAT 704 - Abstract Algebra IV
  - MAT 723 - Advanced Ordinary Differential Equations I and MAT 724 - Advanced Ordinary Differential Equations II
  - MAT 729 - Partial Differential Equations I *and* MAT 730 - Partial Differential Equations II
  - MAT 733 – Topology and MAT 734 – Topology
  - MAT 771 - Applied Analysis I and MAT 772 - Applied Analysis II
  - STA 767 - Mathematical Statistics I and STA 768 - Mathematical Statistics II
- **Additional Courses – Credits: 12.** Complete 12 credits of 700-level MAT or STA courses (excluding MAT 711 & 712), or other advisor-approved courses.
- **Elective Courses – Credits: 24.** Complete 24 credits of 600- or 700-level MAT or STA courses (excluding MAT 711 & 712), or other advisor-approved courses.
- **Dissertation – Credits: 18**
  - MAT 799 - Dissertation

Degree Requirements: *See Plan Degree Requirements below.*
Graduation Requirements: *See Plan Graduation Requirements below.*

Subplan 3 Requirements: Post-Bachelor's - Pure Mathematics Track

Total Credits Required: 78
Course Requirements

- **Required Courses Part 1 – Credits: 6.** Complete two analysis or two theory courses:
  - MAT 707 - Real Analysis I and MAT 708 - Real Analysis II

  OR
  - MAT 709 - Complex Function Theory I and MAT 710 - Complex Function Theory II
- **Required Courses Part 2 – Credits: 6**
  - MAT 703 - Abstract Algebra III
  - MAT 704 - Abstract Algebra IV
- **Subject Area Courses – Credits: 12.** Complete two of the following one-year course sequences:
  - MAT 701 - Foundations of Mathematics III and MAT 702 - Foundations of Mathematics IV
  - MAT 717 - Analytical Solution Methods for Partial Differential Equations, I and MAT 718 - Analytical Solution Methods for Partial Differential Equations, II
  - MAT 723 - Advanced Ordinary Differential Equations I and MAT 724 - Advanced Ordinary Differential Equations II
  - MAT 733 – Topology and MAT 734 – Topology
  - MAT 771 - Applied Analysis I and MAT 772 - Applied Analysis II
  - STA 767 - Mathematical Statistics I and STA 768 - Mathematical Statistics II
- **Additional Courses – Credits: 12.** Complete 12 credits of 700-level MAT or STA courses (excluding MAT 711 & 712), or other advisor-approved courses.
- **Elective Courses – Credits: 24.** Complete 24 credits of 600- or 700-level MAT or STA courses (excluding MAT 711 & 712), or other advisor-approved courses.
- **Dissertation – Credits: 18**
  - MAT 799 - Dissertation

Degree Requirements: *See Plan Degree Requirements below.*
Graduation Requirements: *See Plan Graduation Requirements below.*

Subplan 4 Requirements: Post-Bachelor's - Statistics Track

Total Credits Required: 78
Course Requirements

- **Required Courses Part 1 – Credits: 6**
  - STA 767 - Mathematical Statistics I
  - STA 768 - Mathematical Statistics II
- **Required Courses Part 2 – Credits: 6**
  - STA 761 - Regression Analysis I

  - STA 762 - Regression Analysis II
- **Subject Area Courses – Credits: 12.** Complete two of the following one-year course sequences:
  - STA 713 - Experimental Design and STA 715 - Multivariate Statistical Methods
  - STA 750 - Time Series Analysis and STA 751 - Spatial Statistics
  - STA 755 - Stochastic Modeling I and STA 756 - Stochastic Modeling II
  - STA 753 - Bayesian Data Analysis and STA 765 - Statistical Decision Theory
  - STA 763 - Analysis of Variance I and STA 764 - Analysis of Variance II
  - MAT 707 - Real Analysis I and STA 731 - Probability Theory and Its Applications
- **Additional Courses – Credits: 12.** Complete 12 credits of 700-level MAT or STA courses (excluding MAT 711 & 712), or other advisor-approved courses.
- **Elective Courses – Credits: 24.** Complete 24 credits of 600- or 700-level MAT or STA courses (excluding MAT 711 & 712), or other advisor-approved courses.
- **Dissertation – Credits: 18**
  - STA 799 - Dissertation

Degree Requirements: *See Plan Degree Requirements below.*
Graduation Requirements: *See Plan Graduation Requirements below.*

Subplan 5 Requirements: Post-Master's - Applied Mathematics Track
Credits Required: 48
Course Requirements

- **Required Courses Part 1– Credits: 6.** Complete two analysis or two theory courses:
  - MAT 707 - Real Analysis I and MAT 708 - Real Analysis II

  OR
  - MAT 709 - Complex Function Theory I and MAT 710 - Complex Function Theory II
- **Required Courses Part 2 – Credits: 6**
  - MAT 771 - Applied Analysis I
  - MAT 772 - Applied Analysis II
- **Subject Area Courses – Credits: 12.** Complete two of the following one-year course sequences:
  - MAT 703 - Abstract Algebra III and MAT 704 - Abstract Algebra IV
  - MAT 723 - Advanced Ordinary Differential Equations I and MAT 724 - Advanced Ordinary Differential Equations II
  - MAT 729 - Partial Differential Equations I and MAT 730 - Partial Differential Equations II
  - MAT 733 – Topology and MAT 734 – Topology
  - MAT 765 - Advanced Numerical Analysis and MAT 766 - Advanced Numerical Analysis
  - STA 767 - Mathematical Statistics I and STA 768 - Mathematical Statistics II
- **Elective Courses – Credits: 6.** Complete 6 credits of 600- or 700-level MAT or STA courses (excluding MAT 711 & 712), or other advisor-approved courses.
- **Dissertation – Credits: 18**
  - MAT 799 - Dissertation

Degree Requirements: *See Plan Degree Requirements below.*
Graduation Requirements: *See Plan Graduation Requirements below.*

Subplan 6 Requirements: Post-Master's - Computational Mathematics Track
Total Credits Required: 48
Course Requirements

- **Required Courses Part 1 – Credits: 6.** Complete two analysis or two theory courses:
  - MAT 707 - Real Analysis I and MAT 708 - Real Analysis II

  OR
  - MAT 709 - Complex Function Theory I and MAT 710 - Complex Function Theory II
- **Required Courses Part 2 – Credits: 6**
  - MAT 765 - Advanced Numerical Analysis
  - MAT 766 - Advanced Numerical Analysis
- **Subject Area Courses – Credits: 12.** Complete two of the following one-year course sequences:
  - MAT 703 - Abstract Algebra III and MAT 704 - Abstract Algebra IV
  - MAT 723 - Advanced Ordinary Differential Equations I and MAT 724 - Advanced Ordinary Differential Equations II
  - MAT 729 - Partial Differential Equations I and MAT 730 - Partial Differential Equations II

- MAT 733 – Topology and MAT 734 - Topology
- MAT 771 - Applied Analysis I and MAT 772 - Applied Analysis II
- STA 767 - Mathematical Statistics I and STA 768 - Mathematical Statistics II

- **Elective Courses – Credits: 6.** Complete 6 credits of 600- or 700-level MAT or STA courses (excluding MAT 711 & 712), or other advisor-approved courses.
- **Dissertation – Credits: 18**
  - MAT 799 - Dissertation

Degree Requirements: *See Plan Degree Requirements below.*
Graduation Requirements: *See Plan Graduation Requirements below.*

Subplan 7 Requirements: Post-Master's - Pure Mathematics Track
Total Credits Required: 48
Course Requirements

- **Required Courses Part 1 – Credits: 6.** Complete two analysis or two theory courses:
  - MAT 707 - Real Analysis I and MAT 708 - Real Analysis II

  OR
  - MAT 709 - Complex Function Theory I and MAT 710 - Complex Function Theory II
- **Required Courses Part 2 – Credits: 6**
  - MAT 703 - Abstract Algebra III
  - MAT 704 - Abstract Algebra IV
- **Subject Area Courses – Credits: 12.** Complete two of the following one-year course sequences:
  - MAT 701 - Foundations of Mathematics III and MAT 702 - Foundations of Mathematics IV
  - MAT 717 - Analytical Solution Methods for Partial Differential Equations, I and MAT 718 - Analytical Solution Methods for Partial Differential Equations, II
  - MAT 723 - Advanced Ordinary Differential Equations I and MAT 724 - Advanced Ordinary Differential Equations II
  - MAT 733 – Topology and MAT 734 – Topology
  - MAT 771 - Applied Analysis I and MAT 772 - Applied Analysis II
  - STA 767 - Mathematical Statistics I and STA 768 - Mathematical Statistics II
- **Elective Courses – Credits: 6.** Complete 6 credits of 600- or 700-level MAT or STA courses (excluding MAT 711 & 712), or other advisor-approved courses.
- **Dissertation – Credits: 18**
  - MAT 799 - Dissertation

Degree Requirements: *See Plan Degree Requirements below.*
Graduation Requirements: *See Plan Graduation Requirements below.*

Subplan 8 Requirements: Post-Master's - Statistics Track
Total Credits Required: 48
Course Requirements

- **Required Courses Part 1 – Credits: 6**
  - STA 767 - Mathematical Statistics I
  - STA 768 - Mathematical Statistics II
- **Required Courses Part 2 – Credits: 6**
  - STA 761 - Regression Analysis I
  - STA 762 - Regression Analysis II
- **Subject Area Courses – Credits: 12.** Complete two of the following one-year course sequences:
  - STA 713 - Experimental Design and STA 715 - Multivariate Statistical Methods
  - STA 750 - Time Series Analysis and STA 751 - Spatial Statistics
  - STA 755 - Stochastic Modeling I and STA 756 - Stochastic Modeling II
  - STA 753 - Bayesian Data Analysis and STA 765 - Statistical Decision Theory
  - STA 763 - Analysis of Variance I and STA 764 - Analysis of Variance II
  - MAT 707 - Real Analysis I and STA 731 - Probability Theory and Its Applications
- **Elective Courses – Credits: 6.** Complete 6 credits of 600- or 700-level MAT or STA courses (excluding MAT 711 & 712), or other advisor-approved courses.
- **Dissertation – Credits: 18**
  - STA 799 - Dissertation

Degree Requirements: *See Plan Degree Requirements below.*

Graduation Requirements: *See Plan Graduation Requirements below.*

Plan Degree Requirements

1. Students in a post-bachelor's track must complete a minimum of 60 credits of course work (excluding dissertation), at least 18 of which must be at the 700-level.
2. Students in a post-master's track must complete a minimum of 30 credits of course work (excluding dissertation), at least 18 of which must be at the 700-level.
3. A student must enroll in a minimum of 18 credits of Dissertation.
4. In consultation with his/her advisor, a student will organize a dissertation committee of at least three departmental members. In addition, a fourth member from outside the department, known as the Graduate College Representative, must be appointed. An additional committee member may be added at the student and department's discretion. Please see Graduate College policy for committee appointment guidelines.
5. Qualifying Examination. The purpose of the Qualifying Examination is to measure the student's knowledge of basic graduate course work in selected areas and to make sure that the student is prepared to proceed to more advanced studies.
    a. A doctoral student normally takes the Qualifying Examination within the second year after entering the program, based on the core courses in the student's concentration.
    b. Doctoral students must pass the Qualifying Examination within three years.
    c. The Qualifying Examination consists of two parts, corresponding to Required Courses Part 1 & Part2.
    d. A student who fails the Qualifying Examination on the first attempt will be placed on probation and must complete a second examination within the next twelve months.
        i. A post-bachelor's track student who fails the second examination may be allowed to complete a M.S. degree with the consent of the Graduate Studies Committee. Such a student will not be permitted to seek readmission to the Doctoral Program in Mathematical Sciences at UNLV.
        ii. A post-master's track student who fails the Qualifying Examination a second time will be separated from the program.
6. Subject Area Breadth Requirements. With the goal of encouraging students to be exposed to a broad spectrum of mathematics during their graduate studies, doctoral students are required to take at least two one-year sequence courses with a grade of B or better, in addition to the core courses tested by the Ph.D. Qualifying Examination.
7. The purpose of the Comprehensive Examination is to measure a doctoral student's knowledge of the advanced level graduate work that will be required as the student begins to do original research in his or her area of concentration.
    a. After passing the Qualifying Examination, a student will engage in the approved course work specified by the Doctoral Advisory Committee and submit to the latter a dissertation proposal.
    b. Usually one year after passing the Qualifying Examination, a student will complete the Comprehensive Examination, designed and administered by the Doctoral Advisory Committee, based on the student's course work with focus on his/her ability to perform research on the dissertation proposal.
    c. A student who fails the Comprehensive Examination on the first attempt must complete a second examination within the next semester. A student who fails the examination a second time will be separated from the Doctoral Program.
    d. A student who has successfully passed the Comprehensive Examination will be admitted to Candidacy for the Ph.D. degree and thereby be allowed to proceed with the approved dissertation proposal.
8. A doctoral candidate is expected to complete a dissertation embodying the results of significant original research, which is performed independently by the student, and is acceptable to the student's advisory committee.
9. Skills in foreign languages, computer programming and/or interdisciplinary areas, dependent on the concentration of a student's program, will be determined by the Doctoral Advisory Committee and the Graduate Studies Committee in consultation with the Department Chair.
10. Dissertation Defense. After submitting to the Doctoral Advisory Committee a dissertation draft that was approved by his/her Dissertation Advisor, a candidate will defend orally the dissertation before the Doctoral Advisory Committee and any other graduate faculty members who wish to attend. The Doctoral Advisory Committee will recommend to the Graduate Coordinator/Department Chair whether the dissertation and defense are both satisfactory.
11. Specific degree requirements, including those listed above, are described in detail in the Graduate Student Handbook for the Ph.D. Program, available on the department's web site. The listing of graduate courses is constantly under review. Graduate students will automatically receive new listings. Since some courses are taught on an "on demand" basis, course prerequisites for each of the four concentrations are considered guidelines with courses roughly equivalent accepted as prerequisites, subject to approval of the Graduate Studies Committee and the student's Doctoral Advisory Committee.
12. A student will be placed on academic probation if a minimum of 3.00 GPA is not maintained in all work taken in the

degree program. A grade of C or less in one graduate-level course will cause a student to be placed on academic probation and will elicit a critical review of the student's program by the Graduate Studies Committee.

13. The Graduate College requires a minimum of 50 percent of the total credits required to complete the doctoral degree, exclusive of transferred credits and/or the dissertation, must be earned at UNLV after admission to a graduate degree program.

Plan Graduation Requirements

1. The student must submit all required forms to the Graduate College and then apply for graduation up to two semesters prior to completing his/her degree requirements.

2. The student must submit and successfully defend his/her dissertation by the posted deadline. The defense must be advertised and is open to the public.

3. The student must submit his/her approved, properly formatted hard-copy dissertation to the Graduate College, and submit the approved electronic version to ProQuest by the posted deadline.

7. What additions, corrections, or other changes have been made since the catalog was issued?

None.

B. ***Outcomes and Assessment***

1. Student Learning Outcomes and Program Assessment Plans and Reports by program concentration are listed at http://provost.unlv.edu/Assessment/plans.html. Insert the most recent assessment report directly below.

   The report is attached (Appendix A).

2. Describe specific program changes made based on the program's evaluation of its assessment reports:

   a. Has the program revised its curriculum such as changing prerequisites, adding or eliminating required or elective courses, or co-curricular experiences for the degree(s) in the last 5 years?

   Changes have been made, but not as a result of the Assessment Reports.

   b. If yes, what changes were made and why?
   - We require that students place into Calculus I before they can declare math as their major (new with the Fall 2015 catalog).
   - We designated MATH 251 (Discrete Math I) as our "Milestone" course, and MATH 457 (Real Analysis) as our "Capstone" course. This is working its way through curriculum committees. As our students are already required to take these courses, we do not anticipate any delays from students not satisfying the University mandated milestone and capstone requirements.

   c. Has the program revised course content or instructional approaches (pedagogy, technology) in the last 5 years?
   Our courses are taught by professors, and the way we teach a subject constantly evolves. Within senior and graduate level courses, specific content can vary depending on when the course is taught and particularly on who teaches the course.

   d. If yes, what changes were made and why?

4. Describe any other changes made in the last 5 years (for example, advising) based on assessment reports:

   The mathematics curriculum is very stable, and its evolution follows national trends.

V. RELATIONSHIP TO OTHER PROGRAMS IN SYSTEM

A. ***NSHE System Relationships***

1. What relationship does your program have to other programs (such as transfers, collaborations, partnerships) in the NSHE system?

We have several dual degrees at the graduate level:

- M.S. in Mathematical Sciences and M.A. in Economics
- M.S. in Mathematical Sciences and M.S. in Electrical Engineering
- M.S. in Mathematical Sciences and Ph.D. in Electrical Engineering.

At the undergraduate senior level, we have quite a few courses that support programs in other programs (e.g. in the College of Engineering and College of Education).

With respect to other institutions, we note that all courses adhere to common numbering standards within NSHE. A student can therefore transfer credits between institutions. While we hear that this sometimes happens at the lower levels (e.g. calculus taught at CSN), we are not aware of it happening in the 400 level courses (offered by UNR).

We have no programmatic partnerships with other NSHE institutions. However, the Nevada chapter of the American Statistical Association is quite active and through it, there is a lot of contact with faculty at UNR.

We are collaborating with Clark High School, where a third semester calculus course (MATH 283) is taught. Exams there are set by our department, and credits include a UNLV endorsement.

VI. QUALITY AND ADEQUACY OF RESOURCES

A. *Major Course Offerings*

1. How many major courses have been added or eliminated in the last 5 years? __4__ Added __0__ Eliminated

2. Why were the actions taken?

These courses were added to improve our Ph.D. program. The courses are

- MATH 736/737: Lightning Radiative Transfer I and II
- MATH 776: Topics in Applied Mathematics
- MATH 781: Advanced Graduate Topics: Foundations

3. Have enough courses and sections been offered for students to graduate in a timely manner?
   The low level courses for the major (Calculus, Linear Algebra, etc.) are offered annually, if not every semester. To ensure senior level courses run, we offer them every other year. Our thin faculty is a problem, as we do not always have expertise where we need it, particularly in statistics and algebra. We have no "bench," so we always have problems whenever a faculty member seeks a leave (e.g. for a sabbatical, FMA leave, or administrative/service leave/reduction).

B. *General Education and Non-Major Courses*

1. If your program or unit offers General Education courses, please estimate what proportion of your unit's resources are allocated to this area:
   About 80% of our teaching, by student count, is for the 100 level courses. The rest are for the 200-600 level courses (18%) and graduate courses (700 level, 2%). Of course, our effort is not uniformly distributed, as graduate level courses have lower enrollment. Weighted (using the funding formula), the load is 41%/47%/12%. Please note that remedial math courses (MATH 95/96) are not included in these percentages. While these courses are taught by the MLC, we provide administrative services to these courses (an additional 37%, weighted), such as, scheduling, data keeping, grades entering, and tutoring arrangement, etc. (Update: The MLC just hired an administrator to deal with these courses, so this is no longer a burden on our staff. However, they hired a member of our staff, so now we are down a person.)
   Omitting the remedial courses, our estimate is 41%.

2. For other non-major courses – e.g., upper division for the college or university, estimate your unit's resources allocated to this:

   Many of our upper division courses are service courses for other majors, notably engineering and education. Given that we have about 17 students graduate per year, maybe another 17 who do not finish, and that each takes three math/stat courses per semester, we estimate that 8% of our effort in the upper level undergraduate courses goes to students in the program. Thus, about 35% of our total effort (omitting remedial classes) goes to teaching students not in our program but in upper level courses.

3. Does the combined load from 1 and 2 above affect your unit's ability to offer courses for its major? If so, please describe:

   The combined effort in 1 and 2 above is 76%. About 16% of effort goes to the graduate program. Thus only 8% effort goes to students in our undergraduate program. Of course, this affects them. While it typically does not affect what we offer and in fact might help (by ensuring adequate head counts so courses run), it does affect the pace and topics covered in those courses. It also affects student/professor interactions, as our students are absorbed/lost in a sea of students not in the program. Outside the classroom, we encourage student involvement in our local chapter of Pi Mu Epsilon, a mathematics honor society. This is done through a commitment of space, some resources, and volunteer faculty involvement.

   At the graduate level, it has a huge effect, as our lack of resources and large gen-ed student counts mean graduate assistants teach a lot of students. They currently teach an average of 49 students per class. We would like to see this number lowered to a maximum of 25 students per class.

   Another problem not addressed in the question is with how this affects the way our program is run. We have a number of initiatives that recruit students to our discipline (e.g. the collaboration with Clark High School), but there is room for improvement, particularly along the lines of advertising as we do for the graduate program. Unfortunately, our administrative resources are used up by more pressing problems associated to the huge number of courses we teach.

C. ***Budget (Please have your staff complete the following table of financial expenditures)***

1. The table contains three years of financial expenditures to be used to respond to questions 2 and 3 below. See Appendix B for more details.

Budget category	FY 13-14	FY 14-15	FY 15-16
State Operating (2101)	$ 3,621,355	$ 3,751,585	$ 3,979,369
Student Fees	$ 32,875	$ 218,788	$ 267,357
Indirect Cost Recovery	$ 0	$ 271	$ 99
Self-supporting	$ 87,480	$ 90,354	$ 153,155
Total Allocations	$ 3,976,291	$ 4,123,997	$ 4,165,399
Number of Graduate Assistantships	45 (22 MS, 23 PhD)	45 (19/26)	45 (14/31)

2. Are these resources sufficient to meet the degree program's instructional and scholarship needs?

   No. In particular, we need more graduate assistantships and with higher stipends. We have to cut down our GA workloads and we need a more competitive stipend.

3. If not, approximately what line items and amounts would be needed?

   We would like to see GA stipends increase to $18,000/year. It is currently $12,000/year ($13k if advanced to candidacy). We would like to see a 50% increase in the number of graduate assistantships.

D. ***Other Funding and Resources***

1. Is funding from other sources sufficient to assist the program in achieving its outcomes? Other sources to be considered include: differential tuition, grants and contracts, endowment income, and one-time gifts for student scholarships, other one-time gifts.
   The department generates plenty of money for the University through tuition and the large number of service courses it teaches. The problem is this money does not come back to the department.
   We are grateful for the gifts of scholarships that we already have.
2. If not, which funding streams could most reasonably be increased to help the program attain its outcomes?
   The easiest and cheapest improvement would be to increase the graduate assistantship stipend and create more of them. (Update: The GA stipend will increase this spring semester!)
3. Review the space data for your department and comment on its amount and quality. These data will need to be accessed by an individual with Archibus® access.

Graduate students are currently 3 per office. PTI's are more. We have no more room to expand. Our building is "temporary" and well worn. Our (successful) tutor lab is overcrowded and noisy. We have no additional space for graduate students to hold office hours (at 3 per office, there is no space there). We need space for a computer lab.

The quality of the space is generally below UNLV standards, and this may have a deleterious effect on our program. Image matters to students, and they may correlate the building appearance with the value of the programs (mathematics and statistics) housed in it.

Also, according to PayScale Inc., as cited in the Wall Street Journal, in a survey of salaries for bachelor's degree recipients, the median mid-career mathematician's salary is $92k. The highest paid profession in the survey, chemical engineer, makes just 15% more. Physicist: 5% more. Biologist: 30% less.
http://online.wsj.com/public/resources/documents/info-Degrees_that_Pay_you_Back-sort.html

4. Is the quality and quantity of available consumable materials and supplies adequate and if not, explain why not:
It has been a while since we ran out of copy paper.

5. Is the quality and quantity of available technology resources, such as computers adequate and if not, explain why not:

Some computers should be replaced. Some software is too expensive for the department to pay for licensing.

6. Is the quality and quantity of available equipment (other than computing) adequate and if not, explain why not:
   We are fortunate that, other than our use of computers, our needs are copiers and office supplies, neither of which are major expenditures. Postage, used to advertise our graduate program, is expensive.
7. Is the quality and quantity of available library and information resources adequate and if not, explain why not:
   The Library's practice of obtaining materials upon request is, for the most part, adequate for our research. We note, though, that Top Tier Universities will also make it easy to browse journals. For example, some Universities have current issues of top journals held in the Department's reading room or lounge (no, we do not have either) before they are transferred to the Library for binding and long-term preservation. While this might be something worth considering, it is minor compared to our other needs.
8. Staffing
   a. Are available department staff resources sufficient to attain the program's outcomes?
   We have been fortunate with our current hires, as our office staff, augmented with student aids, is quite efficient. However, we just lost one of our superb staff. We hope to replace her with someone of her equal. Though our student aids have often been quite helpful, there are many tasks they are not allowed to do because of student confidentiality (FERPA laws). There are times of the year (e.g. when budgets are due or the schedule needs building) when our staff is completely absorbed in the task at hand, and unable to attend to urgent matters as they arise.
   b. If not, what additional staff resources are needed and how would they be funded?
   We have had the financial resources in the past (through student fees), but were unable to hire because a line was never created.

VII. WRAP UP

A. ***What are the strengths of the program?***

- Our math majors are taught to be problem solvers, an asset valued by employers.
- Our graduate program is growing both in size and quality. We have reached our self-imposed goal of 30 Ph.D. students, while gradually increasing our admissions standards.

B. ***What are the weaknesses of the program?***

- We do not have much control over the quality of teaching at the lower levels, where classes are taught mainly by graduate students and part time instructors.
- We do not always have the faculty to teach the upper division courses that we would like to offer.

C. ***Retention, Progression, Completion***

1. After reviewing the program, what additional actions should be taken to improve retention, progression, and completion?

As was pointed out earlier, our 6-year graduation rate mirrors that of the University, but fails to accurately portray the program. Prospective students rarely understand what it means to be a mathematics major, so most of our students (87%) transfer into the program. We now require placement into MATH 181 as a requisite to be able to declare math as a major, which we hope will send the right message to prospective students concerning our expectations. We anticipate it will also cut down on the number of students who errantly declare math as their major.

It might be worthwhile contemplating whether there are better metrics for our program.

We are generally happy with our graduate program, though there probably are worthwhile efforts we could act on here. For example, we have a few graduate students who are capable, but seem unmotivated to complete their degrees.

RPC is a headache at the lower levels. There are a couple of strategies we have implemented here. Through the 'Emporium Lab,' we encourage students to do their homework. We compile lists of at risk students after mid-semester grades are recorded and forward those to advisors in the appropriate colleges. We have our own tutoring lab. We try to place students correctly, but we do not have control over this process. In particular, the University has adopted an online placement exam without adopting measures to prevent cheating on that exam.

Our instructors in MATH 126/127 have reported that this semester's students are weaker than in past semesters, and grades in those courses were worse than in past years. We are not certain as to the cause. One problem might be the change in the way the University places students. We are working on obtaining and analyzing relevant data. We are working on alternative hypotheses as well.

D. ***Faculty Review***

1. On what date did the program and/or department faculty review this self-study?

November 20th, 2015.

2. What were the results of the faculty review?

Changes to III.D.2, V.A and VI.D, as well as minor changes.

B. ***Other comments***

1. Is there anything else you would like to discuss about the program?

The Math Learning Center is an entity on campus whose mission and function, as it pertains to our Department, has not been fully explained or documented. It reports directly to the Vice Provost for Academic affairs. Past practice has been that all college-credit courses are offered and run by academic units, while non-college credit courses are offered by both academic units and Educational Outreach, the latter of which is part of the Provost's office. It may be more reasonable to make the Math Learning Center part of Educational Outreach, as it deals exclusively with non-college credit remedial courses (MATH 095 and 096). In fact, at one time MATH 095 and 096 were part of Educational Outreach. However, a "top priority" of the Math Learning Center is to work "on the continued improvement of … lower division mathematics education at UNLV." In as much as the Math Learning Center is involved with college credit mathematics courses, they should report through our Department. This would be

consistent with the UNLV Bylaws, which outlines the genesis and maintenance of college courses as originating and residing within the relevant academic unit. The situation, as it currently exists, is confusing.

A concept similar to the Math Learning Center exists at other Universities (e.g. Arizona State University), but those units lie within the Department. A similar structure, carefully thought out and funded, could benefit the Department and allow it to better concentrate on both its service and programmatic missions.

The Department of Mathematical Sciences is strongly committed to support the University's Top Tier mission and to becoming a world-recognized center of excellence in teaching, research, and service. Given the central importance of mathematics in the university, we foster a supportive atmosphere and provide comprehensive mathematics and statistics education at all level. For the introductory level, we would prefer that resources be provided to address the following challenges.

- Correct placement of students into courses. To this end, the department has constructed its own placement exam, which is a cheaper alternative than the national SAT and ACT exams. NSHE has recently adopted other national exams, most notably ALEKS, which is being administered without any proctoring. We would like to assess the effectiveness of these placement tools.

- Quality and consistency of instructors for the introductory level mathematics. Since many instructors are part time, our workforce has constant turnover and is therefore inconsistent. As a result, the success rates of introductory level mathematics are not in a desirable range. We need to reposition ourselves, pedagogically and structurally. We need to reduce the reliance of part time instructors and to place a knowledgeable and stable faculty team for introductory level mathematics. As indicated before, we need 15 new GA's and 10 new regular faculty to adequately deal with our current situation. As the first step, we propose 6 new FIRs. The main duties of each FIR should be:
    - Teach 4 sections per semester
    - As a course leader, providing leadership to other instructors (PTI and/or graduate TA) and the overall student learning success of the whole course.

  (FIRs should be also encouraged to teach higher leavel math/stat courses if needed, to conduct research, to write funding proposals, and to be good citizens in the Department, College and University)

- Student motivation. Students are often unaware or unwilling to recognize that they must work to pass courses, and that there is a strong correlation between doing homework and getting passing grades. One of our strategies to encourage students to work on their homework in an 'emporium lab.' Students are required to attend the lab sometime during the day that it is running (Friday, usually 8 to 5). In the lab, there are roving teaching assistants ready to help with their homework. Homework is submitted on line, so students who complete their assignments before the lab are excused.