



## Quantitative Reasoning Course Combinations

Academic Planning and Institutional Research, Office of the Provost, September 2015

### Overview and Key Findings

At the request of the Quantitative Reasoning coordinator of the University's General Education Committee, we analyzed student course-taking patterns in the fulfillment of parts A and B of the Quantitative Reasoning General Education Requirements. We were asked to look at the combinations of courses used to fulfill the requirements, and to determine whether some part A courses better prepare students for part B courses.

Key findings:

- Among 2013 and 2014 bachelor's degree recipients 27 percent took a Quantitative Reasoning A (QR-A) course and 92 percent took a Quantitative Reasoning B (QR-B) course at UW-Madison—those not taking Quantitative Reasoning courses at UW-Madison may have fulfilled the requirement, or been exempted, through placement testing, Advanced Placement (AP) credit, or coursework outside of UW-Madison.
- Only 22 percent of 2013 and 2014 graduates took QR-A and QR-B in sequence at UW-Madison; for the 2,847 graduates who did so, they used 169 unique course combinations to fulfill the two course requirement.
- We compared the outcomes in selected QR-B courses based on the QR-A course; we did not find any significant differences in successful course outcomes (grade of C or better) in the selected QR-B course based on the QR-A course the student took.

### About Quantitative Reasoning Requirements

All UW-Madison undergraduate students must satisfy the University's General Education Requirements in order to earn a bachelor's degree. One component of the General Education Requirements is a two-part Quantitative Reasoning requirement. This report looks at the number of students satisfying Quantitative Reasoning requirements with UW-Madison coursework, as well as examining course combinations used to meet the requirements of the two parts.

Quantitative Reasoning Part A (QR-A) is designed to ensure students have the skills in mathematics, computer science, statistics, or formal logic necessary for dealing with quantitative information. QR-A is fulfilled by one of seven designated courses (Table 1). Alternatively, students may be exempt from the QR-A requirement based on approved college work while in high school, AP test scores, or placement testing.

Table 1  
**UW-Madison QR-A Courses**

Course	Credits	Title
COMP SCI 202	3	Introduction to Computation
MATH 112	3	Algebra
MATH 114	5	Algebra and Trigonometry
MATH 130	3	Mathematics for Teaching: Geometry and Measurement
MATH 141	3	Quantitative Reasoning
MATH 171	5	Calculus with Algebra and Trigonometry
PHILOS 210	4	Reason in Communication

Quantitative Reasoning Part B (QR-B) requires more advanced coursework that makes use of quantitative tools in the context of other course material. QR-B is fulfilled by one of many courses from a variety of fields (there were 52 QR-B courses during the period of our analysis). Students satisfy the QR-B requirement by earning course credit for a QR-B course, regardless of whether the course is taken at UW-Madison.

### **Analysis of QR-A and QR-B Patterns**

To analyze Quantitative Reasoning patterns, we limited our analytic population to students who earned a bachelor's degree from UW-Madison in 2013 or 2014 (13,216 students). Table 2 provides basic information on QR-A and QR-B for that population. We determined that 27 percent took a QR-A course at UW-Madison and 92 percent took a QR-B course at UW-Madison. Of the 13,216 students, 22 percent took a QR-A course at UW-Madison followed by a QR-B course at UW-Madison. These students are the focus of our analysis.

Table 2  
**Students Satisfying Quantitative Reasoning Requirements with UW-Madison Courses**  
Students Earning Bachelor's Degrees in 2013 or 2014

	Number	Percent
Total population of students	13,216	100%
Students who took QR-A course at UW-Madison	3,532	27%
Students who took QR-B course at UW-Madison	12,158	92%
Students who took QR-A course followed by QR-B course at UW-Madison	2,847	22%

We looked at each combination in which a student took a QR-A course at UW-Madison followed by a QR-B course at UW-Madison. We looked at only the first instance of QR-A and QR-B for each student. In some cases students took multiple QR-A or multiple QR-B courses in the same semester. In those cases, we included the contemporaneous courses. For the 2,847 students from the analytic cohort who

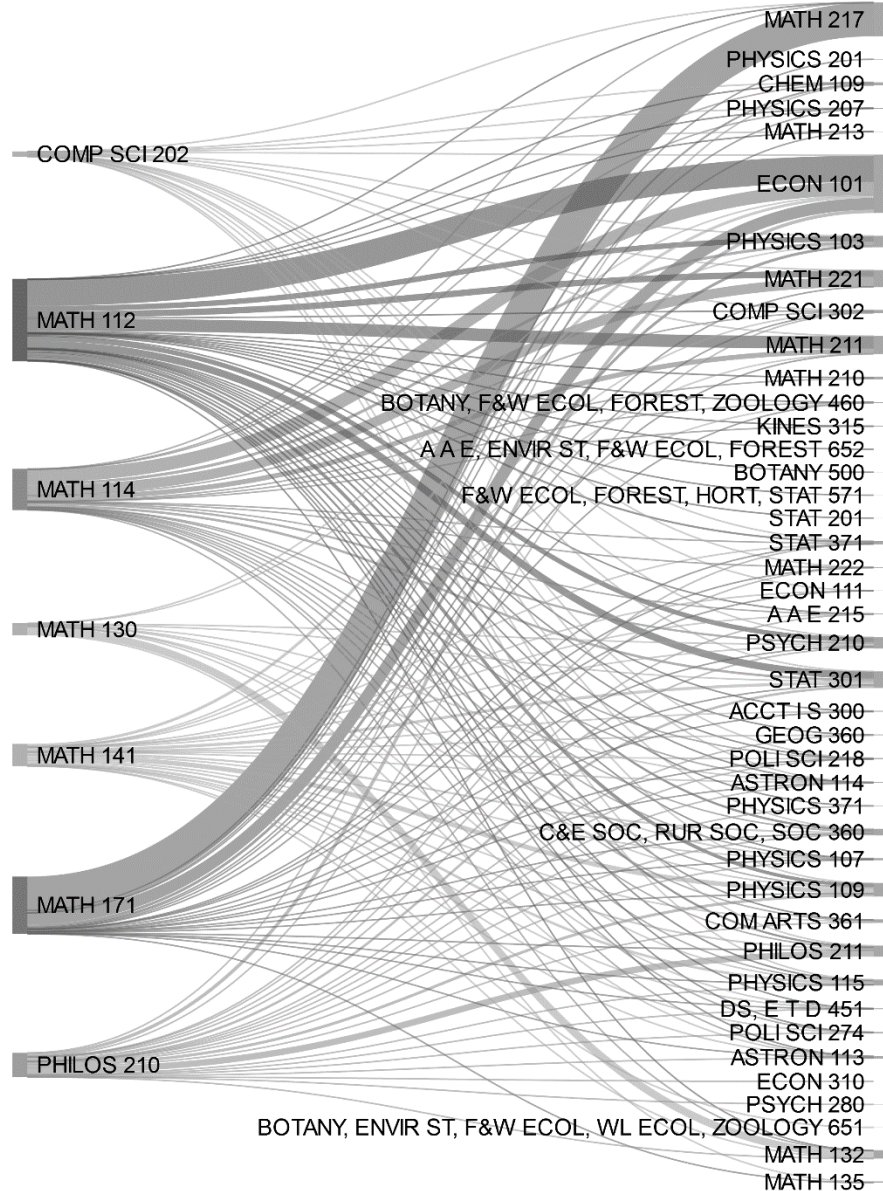
took a QR-A course at UW-Madison followed by a QR-B course at UW-Madison, there were 3,170 instances of QR-A followed by QR-B, including 169 unique course combinations.

Appendix A provides student counts for every course combination. The ten most popular sequences of QR-A to QR-B were:

1. MATH 171 to MATH 217 (433 students)
2. MATH 112 to ECON 101 (340 students)
3. MATH 114 to ECON 101 (169 students)
4. MATH 112 to MATH 211 (161 students)
5. MATH 171 to ECON 101 (152 students)
6. MATH 114 to MATH 221 (127 students)
7. MATH 130 to MATH 132 (97 students)
8. MATH 112 to STAT 301 (93 students)
9. MATH 112 to MATH 221 (82 students)
9. PHILOS 210 to PHILOS 211 (82 students)

Figure 1 provides a visual representation of QR-A/QR-B combinations by showing the flow of students from QR-A courses to QR-B courses. There is a small number of popular combinations, but Figure 1 shows that QR-A students' QR-B choices are widely dispersed. Appendix B shows for each QR-B course the percentage of students from each of the QR-A courses, and includes the percentage of students who did not take QR-A at UW-Madison.

Figure 1  
**Flow of Students<sup>1</sup> from First QR-A Course to First QR-B Course**  
 Students Earning Bachelor's Degrees in 2013 or 2014



<sup>1</sup>Includes only students who took both a QR-A course and a QR-B course at UW-Madison, and the QR-A course preceded the QR-B course.

### Successful QR-B Course Outcomes

For each QR-A/QR-B combination, we looked at whether students achieved a successful course outcome (grade of C or better) in the QR-B course to see if there were significant differences based on the QR-A

course taken. As shown in Table 3, we found no significant differences in the percentage of students with successful course outcomes in the first QR-B course based on which QR-A course was taken.

We did find that students who did not take QR-A at UW-Madison had a significantly higher percentage of successful course outcomes (95 percent) in the first QR-B course compared to students who took QR-A at UW-Madison (89 percent). This may indicate that students who are exempted from QR-A have stronger quantitative skills on average than those developed in QR-A courses.

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**Table 3**  
**Successful Course Outcomes in First QR-B Course, by Prior First QR-A Course**  
 Students Earning Bachelor’s Degrees in 2013 or 2014

	Number of Students	Percentage C or Better
COMP SCI 202	71	87%
MATH 112	1,067	90
MATH 114	534	87
MATH 130	156	94
MATH 141	288	91
MATH 171	740	90
PHILOS 210	314	88
All QR-A Courses <sup>1</sup>	3,170	89
No QR-A at UW-Madison	29,364	95*

<sup>1</sup>Because some students take more than one QR-A course in the first semester of QR-A, or more than one QR-B course in the first semester of QR-B, summing the students from each QR-A courses leads to some duplication.

\*Significantly different from the percentage of students from all QR-A courses based on a chi-square test at 95% confidence interval.

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## Conclusions

Although students earning a bachelor’s degree at UW-Madison must satisfy Quantitative Reasoning requirements, the majority (73 percent) do not take QR-A at UW-Madison. Those that do take QR-A at UW-Madison take a wide range of QR-B courses. We did not find evidence that students from any particular QR-A course achieve successful course outcomes at a higher or lower rate than all QR-A takers.

Appendix A

**QR-A/QR-B Combinations for 2013 and 2014 Graduates**

<b>QR-B Course</b>	<b># of COMPSCI 202 Students</b>	<b>% of COMPSCI 202 Students</b>
ECON 101	15	21.1%
COMP SCI 302	7	9.9%
PHYSICS 109	7	9.9%
MATH 221	6	8.5%
MATH 222	6	8.5%
MATH 211	4	5.6%
MATH 217	4	5.6%
PHILOS 211	3	4.2%
PHYSICS 103	3	4.2%
PSYCH 210	3	4.2%
C&E SOC, RUR SOC, SOC 360	2	2.8%
ECON 111	2	2.8%
STAT 301	2	2.8%
ASTRON 114	1	1.4%
CHEM 109	1	1.4%
MATH 213	1	1.4%
PHYSICS 115	1	1.4%
PHYSICS 207	1	1.4%
POLI SCI 218	1	1.4%
STAT 371	1	1.4%
<b>Total</b>	<b>71</b>	<b>100.0%</b>

Appendix A

**QR-A/QR-B Combinations for 2013 and 2014 Graduates**

<b>QR-B Course</b>	<b># of MATH 112 Students</b>	<b>% of MATH 112 Students</b>
ECON 101	340	31.9%
MATH 211	161	15.1%
STAT 301	93	8.7%
MATH 221	82	7.7%
PHYSICS 103	70	6.6%
PSYCH 210	61	5.7%
PHYSICS 109	44	4.1%
C&E SOC, RUR SOC, SOC 360	28	2.6%
PHILOS 211	26	2.4%
STAT 371	24	2.3%
PHYSICS 115	21	2.0%
MATH 210	20	1.9%
COM ARTS 361	12	1.1%
COMP SCI 302	10	0.9%
PHYSICS 107	8	0.8%
ACCT I S 300	6	0.6%
BOTANY, F&W ECOL, FOREST, ZOOLOGY 460	6	0.6%
CHEM 109	6	0.6%
GEOG 360	6	0.6%
KINES 315	6	0.6%
MATH 132	6	0.6%
A A E 215	5	0.5%
POLI SCI 218	5	0.5%
ASTRON 113	3	0.3%
BOTANY 500	3	0.3%
POLI SCI 274	3	0.3%
DS, E T D 451	2	0.2%
MATH 217	2	0.2%
PHYSICS 371	2	0.2%
A A E, ENVIR ST, F&W ECOL, FOREST 652	1	0.1%
ASTRON 114	1	0.1%
F&W ECOL, FOREST, HORT, STAT 571	1	0.1%
MATH 213	1	0.1%
PHYSICS 207	1	0.1%
STAT 201	1	0.1%
<b>Total</b>	<b>1,067</b>	<b>100.0%</b>

Appendix A

**QR-A/QR-B Combinations for 2013 and 2014 Graduates**

<b>QR-B Course</b>	<b># of MATH 114 Students</b>	<b>% of MATH 114 Students</b>
ECON 101	169	31.7%
MATH 221	127	23.8%
MATH 211	64	12.0%
PHYSICS 103	38	7.1%
STAT 301	31	5.8%
PSYCH 210	27	5.1%
MATH 210	11	2.1%
PHYSICS 109	10	1.9%
STAT 371	9	1.7%
C&E SOC, RUR SOC, SOC 360	6	1.1%
COM ARTS 361	5	0.9%
COMP SCI 302	5	0.9%
PHYSICS 115	5	0.9%
CHEM 109	4	0.8%
MATH 132	3	0.6%
PHILOS 211	3	0.6%
A A E 215	2	0.4%
ASTRON 113	2	0.4%
ASTRON 114	2	0.4%
BOTANY, F&W ECOL, FOREST, ZOOLOGY 460	2	0.4%
PHYSICS 107	2	0.4%
PHYSICS 207	2	0.4%
KINES 315	1	0.2%
MATH 217	1	0.2%
MATH 222	1	0.2%
POLI SCI 218	1	0.2%
POLI SCI 274	1	0.2%
<b>Total</b>	<b>534</b>	<b>100.0%</b>



Appendix A

**QR-A/QR-B Combinations for 2013 and 2014 Graduates**

<b>QR-B Course</b>	<b># of MATH 130 Students</b>	<b>% of MATH 130 Students</b>
MATH 132	97	62.2%
MATH 135	16	10.3%
PHYSICS 109	10	6.4%
PSYCH 210	9	5.8%
STAT 301	8	5.1%
PHYSICS 115	5	3.2%
PHYSICS 103	3	1.9%
ASTRON 113	2	1.3%
ECON 101	2	1.3%
PHYSICS 107	2	1.3%
ASTRON 114	1	0.6%
DS, E T D 451	1	0.6%
Total	156	100.0%

Appendix A

**QR-A/QR-B Combinations for 2013 and 2014 Graduates**

<b>QR-B Course</b>	<b># of MATH 141 Students</b>	<b>% of MATH 141 Students</b>
PHYSICS 109	60	20.8%
STAT 301	37	12.9%
ECON 101	35	12.2%
PHYSICS 115	32	11.1%
C&E SOC, RUR SOC, SOC 360	24	8.3%
PHILOS 211	23	8.0%
PSYCH 210	15	5.2%
COM ARTS 361	14	4.9%
ASTRON 113	10	3.5%
POLI SCI 274	5	1.7%
ACCT I S 300	4	1.4%
DS, E T D 451	4	1.4%
PHYSICS 107	4	1.4%
POLI SCI 218	4	1.4%
ASTRON 114	3	1.0%
GEOG 360	3	1.0%
STAT 371	3	1.0%
BOTANY, F&W ECOL, FOREST, ZOOLOGY 460	2	0.7%
A A E 215	1	0.4%
BOTANY, ENVIR ST, F&W ECOL, WL ECOL, ZOOLOGY 651	1	0.4%
COMP SCI 302	1	0.4%
ECON 111	1	0.4%
MATH 132	1	0.4%
MATH 211	1	0.4%
<b>Total</b>	<b>288</b>	<b>100.0%</b>

Appendix A

**QR-A/QR-B Combinations for 2013 and 2014 Graduates**

<b>QR-B Course</b>	<b># of MATH 171 Students</b>	<b>% of MATH 171 Students</b>
MATH 217	433	58.5%
ECON 101	152	20.5%
PHYSICS 103	35	4.7%
CHEM 109	25	3.4%
STAT 301	14	1.9%
COMP SCI 302	12	1.6%
PSYCH 210	11	1.5%
PHYSICS 109	9	1.2%
PHILOS 211	7	1.0%
MATH 221	6	0.8%
PHYSICS 201	6	0.8%
PHYSICS 207	5	0.7%
MATH 211	4	0.5%
BOTANY, F&W ECOL, FOREST, ZOOLOGY 460	3	0.4%
C&E SOC, RUR SOC, SOC 360	3	0.4%
ASTRON 113	2	0.3%
PHYSICS 107	2	0.3%
STAT 371	2	0.3%
ACCT I S 300	1	0.1%
ASTRON 114	1	0.1%
DS, E T D 451	1	0.1%
ECON 111	1	0.1%
MATH 135	1	0.1%
MATH 213	1	0.1%
MATH 222	1	0.1%
PHYSICS 115	1	0.1%
POLI SCI 218	1	0.1%
Total	740	100.0%

Appendix A

**QR-A/QR-B Combinations for 2013 and 2014 Graduates**

<b>QR-B Course</b>	<b># of PHILOS 210 Students</b>	<b>% of PHILOS 210 Students</b>
PHILOS 211	82	26.1%
ECON 101	43	13.7%
PHYSICS 109	36	11.5%
STAT 301	31	9.9%
C&E SOC, RUR SOC, SOC 360	21	6.7%
PSYCH 210	21	6.7%
ASTRON 113	14	4.5%
COM ARTS 361	13	4.1%
PHYSICS 115	12	3.8%
POLI SCI 274	8	2.6%
PHYSICS 107	7	2.2%
COMP SCI 302	5	1.6%
POLI SCI 218	4	1.3%
DS, E T D 451	3	1.0%
STAT 371	3	1.0%
PHYSICS 371	2	0.6%
PSYCH 280	2	0.6%
A A E 215	1	0.3%
ASTRON 114	1	0.3%
CHEM 109	1	0.3%
ECON 310	1	0.3%
GEOG 360	1	0.3%
MATH 132	1	0.3%
MATH 222	1	0.3%
<b>Total</b>	<b>314</b>	<b>100.0%</b>

## Prior QR-A Course of QR-B Takers, by QR-B Course 2013 and 2014 Graduates

QR-B COURSE	NO UW-MADISON QR-A COURSE	COMP SCI 202	MATH 112	MATH 114	MATH 130	MATH 141	MATH 171	PHILOS 210	NUM OF STUDENTS
ECON 101	73%	1%	12%	6%	0%	1%	5%	2%	2,809
MATH 221	90%	0%	4%	6%	0%	0%	0%	0%	2,214
CHEM 109	97%	0%	1%	0%	0%	0%	2%	0%	1,109
MATH 222	99%	1%	0%	0%	0%	0%	0%	0%	971
MATH 211	74%	0%	18%	7%	0%	0%	0%	0%	885
STAT 301	71%	0%	13%	4%	1%	5%	2%	4%	734
PSYCH 210	74%	1%	11%	5%	2%	3%	2%	4%	563
PHYSICS 103	74%	1%	13%	7%	1%	0%	6%	0%	559
PHYSICS 109	66%	1%	8%	2%	2%	11%	2%	7%	524
MATH 217	0%	1%	0%	0%	0%	0%	98%	0%	440
COMP SCI 302	88%	2%	3%	1%	0%	0%	3%	1%	347
PHILOS 211	56%	1%	8%	1%	0%	7%	2%	25%	324
STAT 371	82%	0%	10%	4%	0%	1%	1%	1%	235
C&E SOC, RUR SOC, SOC 360	60%	1%	13%	3%	0%	11%	1%	10%	210
PHYSICS 207	93%	1%	1%	1%	0%	0%	4%	0%	136
MATH 210	77%	0%	15%	8%	0%	0%	0%	0%	134
MATH 132	17%	0%	5%	2%	75%	1%	0%	1%	130
PHYSICS 115	41%	1%	16%	4%	4%	25%	1%	9%	130
PHYSICS 201	95%	0%	0%	0%	0%	0%	5%	0%	113
ASTRON 113	69%	0%	3%	2%	2%	9%	2%	13%	108
PHYSICS 107	74%	0%	8%	2%	2%	4%	2%	7%	98
STAT 224	100%	0%	0%	0%	0%	0%	0%	0%	86
COM ARTS 361	48%	0%	14%	6%	0%	16%	0%	15%	85
COMP SCI 367	100%	0%	0%	0%	0%	0%	0%	0%	68
MATH 213	95%	2%	2%	0%	0%	0%	2%	0%	64
POLI SCI 274	73%	0%	5%	2%	0%	8%	0%	13%	62
ACCT I S 300	82%	0%	10%	0%	0%	7%	2%	0%	61
POLI SCI 218	72%	2%	9%	2%	0%	7%	2%	7%	57
ECON 111	93%	4%	0%	0%	0%	2%	2%	0%	55
ECON 310	98%	0%	0%	0%	0%	0%	0%	2%	53
MATH 275	100%	0%	0%	0%	0%	0%	0%	0%	52
CHEM 115	100%	0%	0%	0%	0%	0%	0%	0%	51
BOTANY, F&W ECOL, FOREST, ZOOLOGY 460	72%	0%	13%	4%	0%	4%	6%	0%	47
DS, E T D 451	69%	0%	6%	0%	3%	11%	3%	8%	36
COMP SCI, E C E 352	100%	0%	0%	0%	0%	0%	0%	0%	35
ASTRON 114	67%	3%	3%	7%	3%	10%	3%	3%	30
GEOG 360	58%	0%	25%	0%	0%	13%	0%	4%	24
COMP SCI, E C E 354	100%	0%	0%	0%	0%	0%	0%	0%	20
MATH 135	6%	0%	0%	0%	89%	0%	6%	0%	18
A A E 215	31%	0%	38%	15%	0%	8%	0%	8%	13
KINES 315	46%	0%	46%	8%	0%	0%	0%	0%	13
BOTANY, ENVIR ST, F&W ECOL, WL ECOL, ZOOLOGY 651	92%	0%	0%	0%	0%	8%	0%	0%	12
PHYSICS 371	60%	0%	20%	0%	0%	0%	0%	20%	10
PSYCH 280	80%	0%	0%	0%	0%	0%	0%	20%	10
B M I, STAT 541	100%	0%	0%	0%	0%	0%	0%	0%	8
BOTANY 500	63%	0%	38%	0%	0%	0%	0%	0%	8
A A E, ENVIR ST, F&W ECOL, FOREST 652	86%	0%	14%	0%	0%	0%	0%	0%	7
STAT 333	100%	0%	0%	0%	0%	0%	0%	0%	7
POLI SCI, PUB AFFR 551	100%	0%	0%	0%	0%	0%	0%	0%	3
F&W ECOL, FOREST, HORT, STAT 571	50%	0%	50%	0%	0%	0%	0%	0%	2
STAT 201	50%	0%	50%	0%	0%	0%	0%	0%	2
STAT 302	100%	0%	0%	0%	0%	0%	0%	0%	1
<b>TOTAL</b>	<b>77%</b>	<b>1%</b>	<b>8%</b>	<b>4%</b>	<b>1%</b>	<b>2%</b>	<b>5%</b>	<b>2%</b>	