Course Syllabus

Course Number: MS110
Course Title: Quantitative Literacy and Reasoning

Class Meetings:	Section A, Wednesday, 7:30-11:30pm, Rm. 201, Bldg. 2900. The quarter begins on Monday, 1/07/2013 and ends on Saturday, 3/23/2013
Session/Year:	Wi13
Instructor Name:	Dr. Pete Markiewicz
Email Address:	pmarkiewicz@aii.edu
Phone:	Comeon, it's the 21st century. If you don't have email, SEE INSTRUCTOR IMMEDIATELY
Class website:	http://www.plyojump.com/courses (not used this quarter)
Contact me at:	pmarkiewicz@aii.edu
Office Hours:	Wednesday, 12:00-4:00pm, Rm. 321, 2950 Bldg. (the Tutoring Center, near the Library and Registrar)
Facebook, Linkedin	Username: "pindiespace"
Khan Academy	Username: "pindiespace"
Second Life	Students may also access "virtual office hours" during the same time as regular office hours by meeting the Instructor in the Second Life 3D virtual world (download client at http://www.secondlife.com) during Office Hours. Search for avatar "pindiespace potato"

Quantitative Literacy and Reasoning

Course Description:
This course develops conceptual understanding of problem solving, decision-making, and analytic skills dealing with quantities and their magnitudes and interrelationships. Students create logical statements and arguments in a real-world context using real-world examples and datasets. Students will estimate, approximate, and judge the reasonableness of answers. Students will select and use appropriate approaches and tools in formulating and solving real-world problems.

Course Focus: *This course is designed to give students "math literacy" in the real world, as opposed to learning basic arithmetic and algebra. Students will apply their basic math skills to understand real-world situations and problems using quantity and logical thinking. Students will be prepared to evaluate quantitative arguments and construct quantitative models in areas they are likely to encounter in the media and society - including financial, energy, health, environmental, and cosmological issues.*

Course Length:	11 Weeks	
Contact Hours:		44 Hours
	Lecture:	4 Hours per week
	Lab:	0 Hours per week
Credit Values:	3 Credits	

Quarter Credit Hour Definition:
A quarter credit hour is an amount of work represented in intended learning outcomes and verified by evidence of student achievement that is an institutionally established equivalency that reasonably approximates not less than:

(1) One hour of classroom or direct faculty instruction and a minimum of two hours of out-of-class student work each week for 10-12 weeks, or the equivalent amount of work over a different amount of

time; or

(2) At least an equivalent amount of work as required in paragraph (1) of this definition for other academic activities as established by the institution including laboratory work, internships, practical, studio work, and other academic work leading to the award of credit hours.

Course Competencies:
Upon successful completion of this course, the student should be able to:

- Solve basic arithmetic problems
- Understand fractions, decimals, percents, and powers
- Understand common units of measurement for time, volume, distance, and energy
- Understand conversions between different measurement units
- Understand the concepts of powers, logarithms, and scientific notation
- Understand proper use of ratios and proportions
- Understand incremental, linear and exponential change.
- Solve problems using Set Theory and Venn Diagrams
- Develop Truth Tables using connectives
- Demonstrate probability and apply it to predict outcomes
- Use basic concepts of statistics, including mean, median, mode, and standard deviation
- Apply algebraic concepts of point, line, slope, and linear and quadratic equations to explain numerical data.
- Articulate the goals, research methodologies, and issues common to mathematicians and scientists when they analyze problems.
- Apply quantitative literacy arguments to current topics in the media and public life.

Course Focus Competencies:

- Learn fast methods for approximate solutions for quantitative problems.
- Define the range and limits of quantitative thinking
- Learn how to research quantitative problems on the Internet.
- Develop skills for extracting the quantitative components of social and political stories in the media.
- Understand how quantitative literacy informs and impacts sustainable design theory.
- Construct simple models of quantitative systems in the energy, health, environmental, and financial areas.
- Defend ideas based on quantitative arguments.

Course Prerequisite(s): None.

Method of Instruction:
The course will be taught using a combination of lecture, in-class projects, and group projects done as homework. Lectures will cover a specific topic in quantitative literacy, after which the instructor will present a specific problem or group of problems for students to solve in class related to the lecture topic. All problems will be solvable with basic math using longhand or a calculator. Depending on the in-class problem assigned, students may work individually, or in several small groups. The instructor may elect to discuss/analyze student in-class solutions to the problem during the remainder of class.

Students will apply the basic quantitative literacy principle to real-world problems, and gain skill in applying formal/math techniques multiple times to arrive at a final solution. Students will also lean how to work with each other in groups. This includes cross-checking each other's answers, organizing division of labor in solving a problem, and developing a final statement/report for presentation when the problem is complete.

There will be a midterm test evaluating students' skills. Students also will collaborate in a quarter-long project which replaces a final exam. The Instructor will provide a list of quarter projects and assign students into 3-5 teams depending on the size of the class. Students will be responsible for finding and documenting raw data used to complete the problem. Quarter projects will constitute the final for the class, and will be presented by student groups during the final two weeks of the quarter. Results will be presented by students using oral lecture, PowerPoint, and boardwork.

Students will participate in in-class group projects. Typically, these projects will focus on an application of numbers for one student major at Ai. Students majoring in these fields may be chosen to lead these groups, based on their (assumed) greater expertise.

Students will also participate in group projects outside of class. These LAB projects account for the majority of the final grade in the course. Student groups are expected to conduct independent research for the individual LAB projects. This includes research in books and on the Internet, as well as email/phone queries to experts in the fields covered by each LAB project. Students are REQUIRED to reference experts in the field their group has personally contacted. Reference books may provide you with names of experts. Students are expected to exert critical thinking evaluating information for individual experts.

Text(s): REQURIED, Math & YOU, by Ron Larson, http://www.mathandyou.com. SIBN: 978-1-60840-602-9

Website(s): REQUIRED: Math.& YOU, http://www.mathandyou.com. A great resource for quantitative literacy problems. Contact the Instructor to certify work on the site for extra credit.

Website(s): SUGGESTED. The Khan Academy, http://www.khanacademy.org/. Your instructor is a coach under username "pindiespace". Contact the Instructor if you plan to complete assignments for extra credit.

Text(s): SUGGESTED, *Everyday Math for Everyday Life: A Handbook for When it Just Doesn't Add Up*, by Mark Ryan, Warner Books, 2002, ISBN: 0446677264.

LAB projects: See the individual LAB projects for reference books.

Materials and Supplies: Calculator, pen and paper.

Estimated Homework Hours: 2 Hours per week

Technology Needed: Access to the Internet outside of class.

Quarterly project topics (NOT ALL WILL BE AVAILABLE IN A GIVEN QUARTER):

- **LAB Project 1 – "Viability of biodiesel"**

  Students will determine if "bio-diesel" (fuel oil derived from plants) is a viable alternative to conventional fossil fuels. Based on research, they will construct a model for biodiesel production including all aspects (crop growth, harvesting, processing, transport of fuel). They will use basic equations to calculate the Return on Energy (ROE), efficiency, and other parameters related to biodiesel production. Students will ***defend*** their research before the class with the use of a linear model, a multimedia presentation and supporting documentation.

- **LAB Project 2 – "Replacing automobiles with compact fluorescent lights"**

  According to Southern California Edison (SCE), "If every household in California swapped out five incandescent light bulbs for CFLs, the greenhouse gas emissions reductions would be equivalent to taking more than 400,000 cars off the road." Students will determine the accuracy of this statement, defining what a household is, how many there are in the state of California and then move on to

analyze all other underlying data used to generate the SCE hypothesis. Finally, students will ***defend*** their research before the class with the use of a linear model, a multimedia presentation and supporting documentation.

- **LAB Project 3 – "Probability of alien life"**

Students will determine the likelihood of intelligent life on other planets using the Drake Equation as a starting point. Students will research the Drake Equation, the research the "best guess" for the probabilities of each component of the equation. Students will develop graphical charts representing the likelihood of alien life based on these estimates, and determine which components of the Drake equation are known, and which are estimates. They will derive a set of values for the equation, and indicate their best current estimate. Students will ***defend*** their research before the class with the use of a linear model, a multimedia presentation and supporting documentation.

- **LAB Project 4 – "Our friend corn"**

Students will determine the percent of corn and corn by-products appearing in common foods. Students will then keep a weekly inventory of all products eaten during a two-week period, checking the ingredient list of everything they consume. Students will research, where possible, the percentage values of corn-related products and by-products (e.g. high-fructose corn syrup or HFCS) in each item of food. In the case where ingredients are not listed or numeric quantities are not present, (e.g. fresh meat), students will conduct research to estimate the percent of mass provided by corn. Students will record their results in an Excel spreadsheet, and calculate the percent of their body mass that came from corn during the study period. Students will ***defend*** their research before the class with the use of a linear model, a multimedia presentation and supporting documentation.

- **LAB Project 5 – "Viability of electric and plug-in hybrid, and hybrid cars"**

Electric cars, hybrid cars, and plug-in hybrid cars have been touted by some as the wave of the future in automotive technology, and a solution to global warming and oil imports. Others believe that these new technologies will actually cause us to burn more oil and increase global warming. What is the EROI (Energy Return on Investment) for hybrids and plug-in hybrids? Can hybrid technologies solve the world energy crisis? How will costs for upgrading the electric grid affect the value of plug-in hybrids? Students will research how hybrid and battery technology works. They will determine the overall energy efficiency for conventional automobiles, hybrids, and plug-in hybrids, and determine the net energy use of each technology. Finally, they will determine the overall fossil fuel consumption for a fleet of each kind of car (assuming electricity is generated by burning oil and/or natural gas). Finally, students will computer the number of windmills and amount of oil that would have to be present to provide the equivalent amount of energy. They will recommend which of these technologies we should adopt, and to what extent. Students will ***defend*** their research before the class with the use of a linear model, a multimedia presentation and supporting documentation..

- **LAB Project 6 – "Global warming, cooling, or something else?"**

A long-standing debate over climate change heated up in late 2009 with the leak of emails from major climate change institutions and researchers. These papers, which show an attempt to "fudge" data in favor of one position, have only added to the emotional debate? But what are the numbers? How has the earth heated up and cooled in the past. Is the current period exceptional? How much of global warming and/or cooling can be attributed to the activities of humans? Students will research climate change in the past, explore the validity of the statistics used to process climate change data, and present a balanced view of the data based on data ONLY. Multiple sources with primary data are required (no blogger posts)They will estimate the risk for climate change impacting our society in the next 10, 20, and 40 years. Students will ***defend*** their research before the class with the use of a linear model, a multimedia presentation and supporting documentation.

- **LAB Project 7 – "Handguns or Cellphones – which kills more? "**

Many commonly used items are directly, or indirectly the cause of death and suffering. In this study, students will compare the effects of unattended driving while using cellphones to handguns in terms

of death and suffering caused. Students will research mortality rates for these items, plot them over time, and compute a cost/benefit ratio for each of the technologies. Students will defend their research before the class with the use of a linear model, a multimedia presentation, and supporting documentation.

Grading Scale:
All assignments must have clear criteria and objectives to meet. All students shall be treated equitably. It will be that student's right to know his/her grade at any reasonable point that information is requested by that student. The criteria for determining a student's grade shall be as follows (on a percentage of total points basis):

A	100-93
A-	92-90
B+	89-87
B	86-83
B-	82-80
C+	79-77
C	76-73
C-	72-70
D+	69-67
D	66-65
F	64 or below

Assessment Criteria and Methods of Evaluating Students:

Participation and Quizzes	20%
Mini-projects	35%
Midterm Exams	20%
Final Project	25%
Total:	100%

Student Evaluation/Grading Policies:

- Class time will be spent in a productive manner.
- Grading will be done on a point system.
- Points for individual activities will be announced.
- All work must be received by the set deadlines.
- Late work receives a grade of zero.
- On-time projects may be redone with instructor approval.
- ABSOLUTELY NO WORK WILL BE ACCEPTED AFTER THE FINAL CLASS MEETS WEEK 11.

Classroom Policy:

- No food allowed in class or lab at any time. Drinks in recoverable bottles allowed in classroom.
- Edible items brought to class or lab must be thrown out.
- If student elects to eat/drink outside class or lab door, missed time is recorded as absent.
- Attendance is taken hourly. Tardiness or absence is recorded in 15-minute increments.
- Break times are scheduled by the instructor at appropriate intervals.
- No private software is to be brought to lab or loaded onto school computers.
- No software games are allowed in lab (unless in course curriculum).
- Headphones are required if listening to music during lab. No headphones are allowed in lecture.
- Any student who has special needs that may affect his or her performance in this class is asked to identify his/her needs to the instructor in private by the end of the first day of class. Any resulting class performance problems that may arise for those who do not identify their needs will not receive any special grading considerations.

School-wide Attendance Policy: Students who do not attend any classes for fourteen consecutive calendar days and fail to notify the Academic Affairs Department, will be withdrawn from school.

Liberal Studies Attendance Policy: Students are expected to be on time to each class and stay for the entire class period. Attendance is mandatory. Tardiness or absence is recorded in 15-minute increments.

If you miss more than 2 classes (20% = 8.8 hours) you will be not be able to pass the class.

Policy for this Instructor:

1. **If you don't understand, come to office hours…**
2. **Office hours are not a second lecture** – they are designed to give you additional help for problems you didn't understand in class.
3. **You are completely responsible** for your own performance in class.
4. **Students will complete all work** in the syllabus. If there is a school holiday, you are still expected to complete assignments for that week.

Disability Policy Statement:
"It is our policy not to discriminate against qualified students with documented disabilities in our educational programs, activities, or services.

Best of Quarter Student Work
Each quarter the instructor will select the best student work, creative and/or scholarly, to submit to the Liberal Studies Honor Committee. The Best Creative Work award will be given to the student whose work displays the greatest creativity and originality. The Best Scholarly Work award will be given to the student whose work best reflects critical thought and analysis. The chosen works and their authors will be formally recognized by the Liberal Studies Department Honors Committee.

Course Outline

Monday, Jan 21 and Friday, Feb 22 are Campus Holidays. No classes are scheduled.

Week/Day	Topics
	Introduction to Quantitative Reasoning
1	**LECTURE:** Introduction, syllabus review, discussion of quarterly project. Quantitative thinking versus (not necessarily bad) Magical thinking. **TEASER:** Entry evaluation exam. **LAB:** Political Handshakes (ultra-basic math leading to a surprising conclusion) **HOMEWORK**: The "Santa Claus" Hypothesis (if we assume Santa exists, what is he actually like?)
	Logic, Basic Math, and Set Theory
2	**TEASER:** Bomber Armor (logic exercise) **LECTURE:** Logic and basic math. Arithmetic fundamentals. Types of numbers (abstract, practical, proofy). Bogus numbers. The central importance of division. Logic, Venn Diagrams, and Truth Tables. Set Theory. Why we don't always need exact numbers. "Ballpark" calculations vs. exact math, and their uses. **LAB:** Set Theory and Venn Diagrams. Basic math operations. "Ballpark" reasoning strategies. Rounding, approximation, when to multiply or divide. **HOMEWORK:** Calculator-Free Calculating. Students decide on which quarterly project to pursue.
	Fractions, Decimals and Percentage

3	**TEASER:** The "Million Solar Panel" Project (evaluate a published press release about "green" energy efficiency via numbers) **LECTURE:** Fractions, decimals, and percents (all division). Converting between fractions, decimals, and percents. Big and Small numbers, scientific notation. The Central versus the Peripheral route in reasoning. **LAB:** Big and small numbers used on the Internet for computer bandwidth calculations (e.g. transmission of movie over a network). Students begin to form final project groups **HOMEWORK:** Fraction Math
	Ratios and Proportions, Powers and Roots, Geometry
4	**TEASER:** Your Personal Stake in the Financial Crisis (what bail-outs actually mean for taxes) **LECTURE:** Ratios and Proportions. Powers and Roots. Basic Geometry. Proofiness (the math equivalent of "truthy"). Midterm review. **LAB:** Area and volume calculations for visual media. Students MUST join group. **HOMEWORK:** Stocks and bonds, Powers and Roots (due Week 06). Prepare for Midterm.
	MIDTERM TEST
5	**LAB:** Midterm Test **HOMEWORK:** Powers and Roots, Stocks and Bonds (due Week 06)
	Measurement and Conversion
6	**TEASER:** Divorce and Sustainability (is married vs. divorced more energy efficient?) **LECTURE:** Measure and conversion **LAB:** Review "Stocks and Bonds" and "Powers and Roots". Students Groups introduce themselves to each other, identifying their 'Excel Guru' and 'Powerpoint Guru'. "Measurement and Conversion" (group) **HOMEWORK:** Santa Monica Bay Pollution computations (what do you personally contribute to pollution)
	Linear and Nonlinear Change
7	**TEASER:** Housing Prices/Rate of Change. Your student loan (interest calculations). **LECTURE:** PRELIM PRESENTATION NEXT WEEK. Units of measurement. Interconverting units. Common units used in energy calculations. **LAB:** Credit Card calculations. Your Fertility Drop calculations. **HOMEWORK:** PRELIM PREP NEXT WEEK
	Probability and Odds, PRELIM PRESENTATIONS
8	**TEASER:** Which people should you save? (logic problem) **LECTURE:**

	Probability and odds. **LAB:** Skin Color probability (Venn Diagrams) **HOMEWORK:** Probability. PREPARE FOR PRELIM PRESENTATION NEXT WEEK.
	Statistics, PRELIM PRESENTATION
9	**TEASER:** Plug-In Hybrid energy efficiency computations (it's not good) **LECTURE:** Statistics. Mean, Median, Mode. Which to use. The "Wisdom of the Crowd" **LAB:** Mis-use of statistics in the media (Young Adult Promiscuity reports). Millennial Trend questionnaire and statistical analysis **HOMEWORK:** The Wisdom of the Crowd
	Charts and Graphs
10	**TEASER:** The "Iron Triangle" (interpreting a complex chart) **LECTURE:** Interpreting Charts and Graphs. Common use and mis-use of charts and graphs in media. **LAB:** Prepare for FINAL PRESENTATION NEXT WEEK.
	FINAL PROJECT PRESENTATION
11	• ***Congratulations – You are Done!***