
Math 114 Exam 1

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General guidelines

- When you've solved a problem (perhaps at the back of the blue book, or on scrap paper) write your answer out neatly starting on a new page in the blue book. Make it easy for me to find each problem. Don't just circle a number. Show all units, and write complete sentences. If you've used any technology, say so.
- Remember to *read the questions carefully* before you start playing with the numbers.
- The purpose of this course is to help you learn how to use quantitative reasoning principles to solve real problems that matter to you. An exam can't test that well because you must answer the questions quickly. Here's a compromise. For homework for Thursday, rethink your answers. If you can write better ones, submit them. (Don't redo problems you got right the first time.) I will correct both the exam and the resubmissions. Getting a problem right the second time isn't worth as much as getting it right the first time, but it can make a difference in your grade. The exam is posted on the course web page at <http://www.cs.umb.edu/~eb/114/exam1/exam1.pdf>.

Work independently. You can email me with questions, but don't consult with friends or classmates or tutors.

- The exam is "open everything." Google (and the internet), calculators, class notes and the text are all OK. Of course you can't use the computer to exchange email with your classmates during the exam. No text messages either, please.

Use the web wisely, and not too much! Most of the calculations can be done with the numbers in the exam. Quick searches should find what you need from the web – don't surf around. Document your sources – "found it on google" isn't good enough.

- Remember to show only the number of significant digits (precision) in your answer justified by the numbers you start with and the estimates you make.
- Write complete sentences. Don't use arrows and equal signs instead of the words that explain what numbers mean and what you are doing. You don't need to show me your arithmetic.

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1. (5 points) Read the general guidelines - particularly the first two about the form your answers should take, and the chance to improve your answers between now and Thursday. Write “I understand the instructions” as an answer for a free 5 points.

2. (15 points) Penny Dreadful

On page 60 of the March 31, 2008 issue of *The New Yorker* David Owen wrote

Breaking stride to pick up a penny, if it takes more than 6.15 seconds,
pays less than the federal minimum wage.

- (a) Use the information in the quotation to figure out the minimum wage when Owen wrote his article.
- (b) Check Owen’s arithmetic by comparing your answer to the actual federal minimum wage at that time. (This information is available on the web and in the text.)

3. (45 points) Taking care of your kids

On October 4, 2014 Josh Boak of the Associated Press reported that

When the Great Recession struck in late 2007 and squeezed most family budgets, the top 10 percent of earners – with incomes averaging \$253,146 – went in a different direction: They doubled down on their kids’ futures.

Their average education spending per child jumped 35 percent to \$5,210 a year during the recession compared with the two preceding years. For the remaining 90 percent of households, such spending averaged about a flat \$1,000, according to research by Emory University sociologist Sabino Kornrich.¹

Use the numbers in the quotation as much as you can to answer the questions that follow. When you need numbers that aren’t there, estimate them, with or without the web. Be clear about any assumptions you make. If you do look things up, be sure to cite your sources.

- (a) What were the wealthiest households spending per child on education before the increase?
- (b) What percentage of their income were the the wealthiest households spending on education after the increase?
- (c) How did the percentage of their income devoted to education change when the recession started.

¹<http://bigstory.ap.org/article/e59ee3ddaef64e2ebc75e081bf9f1d40/school-spending-affluent-widening-wealth-gap>. You won’t find any more helpful information reading the article.

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- (d) What was the average education spending per child for all households?
 - (e) Estimate the 2007 total national household annual education spending on which this study is based.
 - (f) What does “double down” mean? Did the wealthiest households double down on education spending?

4. (35 points) Too many plastic bags.

An article from October 3, 2007 in *The Washington Post* about how paper and plastic bags impact the environment, stated that: “Worldwide, an estimated 4 billion plastic bags end up as litter each year. Tied end to end, the bags could circle the Earth 63 times.”

- (a) Are the numbers “4 billion plastic bags” and “circle the Earth 63 times” consistent?
- (b) Use an estimate of the population of the United States and some common sense to estimate how many plastic bags are used in the United States each year. Use your answer to show that the 4 billion plastic bag claim is too small by several orders of magnitude.
- (c) Confirm your U.S. estimate with a web search.