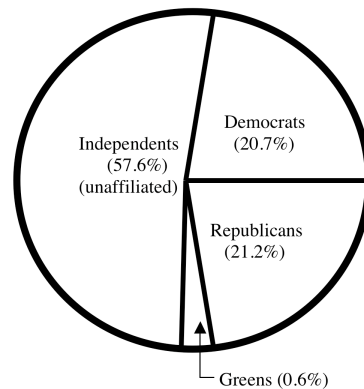


**MATHEMATICS AND LIBERAL ARTS – SAMPLE FINAL EXAM  
FALL 2005**

Name (legibly): \_\_\_\_\_ Signature: \_\_\_\_\_

**Part I.** Answer all. Clearly write **T** for true or **F** for false (5 points each).

- (1) \_\_\_ The number 34,750 written using scientific notation would be  $3.4750 \times 10^4$ .
- (2) \_\_\_ The solution to the following problem should be expressed with four significant digits: What is the average speed of a train that travels 1128 km in 104 minutes?
- (3) \_\_\_ You need to put carpet in a rectangular room that measures 9 feet by 14 feet at a cost of \$22.50 per square yard. Assuming you can buy precisely the amount of carpet you need, it would cost more than \$310.00 for the carpet for the room.
- (4) \_\_\_ If you are on a Canadian road where the speed limit is 90 km/hour and your speed is 55 miles/hour, then you are not exceeding the speed limit.
- (5) \_\_\_ If the cost of a camera after 6% tax has been added is \$48, then to find the original price of the camera you could solve the following equation for  $p$ :  $1.06p = 48$ .
- (6) \_\_\_ If Amanda makes her monthly mortgage payment of \$635.50 on a loan principal of \$106,000 for the full 30 years of the loan, then she will pay more than \$120,000 in interest over the life of the loan.
- (7) \_\_\_ If Lee was single, with a taxable income of \$20,000 for 2003, then the income tax he owed was approximately \$1,000.
- (8) \_\_\_ The statement *Wholesale prices are 25% less than retail prices* is equivalent to saying *Wholesale prices are 75% of retail prices*.
- (9) \_\_\_ The pie chart accurately and precisely represents the information reported in the *Rocky Mountain News* that 52,290 voters between the ages of 18 and 24 registered to vote in September and October in Colorado with 10,813 registering as Democrats, 11,075 as Republicans, 291 as Greens, and 30,111 as independent of either party.
- (10) \_\_\_ If a poll result says that 76% of the voters approve of the governor with a 4 percentage point margin of error, then the confidence interval for the poll is 72% to 80%.
- (11) \_\_\_ The following describes the use of *stratified sampling*: An IRS auditor randomly selects 300 U.S. taxpayers and audits them.
- (12) \_\_\_ If a poll result says that 76% of the voters approve of the governor with a 4 percentage point margin of error, then the confidence interval for the poll is 72% to 80%.
- (13) \_\_\_ If your first five rolls of a fair die are: 1, 2, 3, 4, 5, then the probability of getting a 6 on the next roll of that die is higher than the probability of getting a 3 on the next roll.
- (14) \_\_\_ The theoretical probability of selecting a blue candy from a bag containing 10 red candies, 12 blue candies, 5 yellow candies, and 17 brown candies is  $\frac{12}{10 + 12 + 5 + 17}$ .



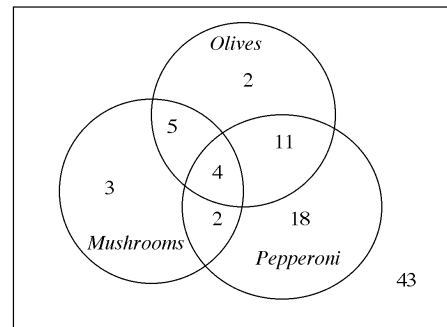
- (15) \_\_\_ You could tile a rectangular patio with bricks shaped like the figure shown and there would be no significant gaps or spaces.



- (16) \_\_\_ Baby Bonnie’s true weight is 6.44 pounds. A scale at the hospital that gives weight measurements to the nearest half pound gives her weight as 6.5 pounds. A digital scale at the doctor’s office reading to the nearest hundredth pound gives her weight as 6.37 pounds. The doctor’s scale is both more precise and more accurate.
- (17) \_\_\_ The statement *C*: *Congress voted against the veto of the tax-increase bill* is logically equivalent to *Congress supported the tax-increase bill*.

**Part II.** Answer **all four**. Please write work and answers on other paper. State each answer using complete sentence(s). Start each of the four problems on a new sheet (yes, you may write on the back of the sheets). Nothing written on this page for these problems will be graded.

- (1) Refer to the Venn diagram of pizza toppings for all of Pizza Haus orders on Saturday to answer the following questions (3 points each).
- How many orders on Saturday had pepperoni?
  - How many orders had mushrooms but not pepperoni?
  - How many orders were there?
  - What does the number 43 in the diagram represent?



Pizza toppings ordered at Pizza Haus on Saturday

- (2) A class of 20 students earned the following grades on an exam:  
 63 87 52 91 88    87 73 74 72 79    79 68 95 99 82    79 69 71 77 90
- Make a frequency table (using 10 point bins) for the data. Include all four columns: Score categories, Frequency, Relative frequency, and Cumulative frequency. (6 points)
  - Give a graphical display of the data. (6 points)
- (3) Congratulations! Only three years out of college, you’re 25, and you got a new job! Now, you have an extra \$200 per month to spend... or invest. Suppose you want to retire when you are 65. You have devised two investment strategies: *Play Now* and *Save Now*:  
*Play Now* means you wait for five years to begin saving. It’s pretty likely you will be able to get a fixed APR of 7.5%, compounded monthly, in five years. With this plan you begin saving five years from now, making monthly deposits of \$200.  
*Save Now* means you begin investing right away, \$200 per month in a retirement plan with a fixed APR of 7.25%, compounded monthly.
- How much money will be in your account when you are 65 with the *Play Now* plan? Show work and justify your answer. (3 points)
  - How much money will be in your account when you are 65 with the *Save Now* plan? Show work and justify your answer. (3 points)
  - Is there a better plan? Explain. (3 points)

- (4) The following table shows annual average employment and unemployment data for New York City and Greeley, Colorado, for 1995 through 2002.

|      | New York           |                   | Greeley            |                   |
|------|--------------------|-------------------|--------------------|-------------------|
|      | <i>Labor Force</i> | <i>Unemployed</i> | <i>Labor Force</i> | <i>Unemployed</i> |
| 1995 | 3,807,601          | 279,652           | 78,802             | 3,722             |
| 1996 | 3,909,947          | 313,933           | 78,177             | 3,674             |
| 1997 | 4,044,896          | 343,541           | 80,037             | 3,108             |
| 1998 | 4,097,657          | 297,841           | 84,704             | 3,829             |
| 1999 | 4,097,769          | 253,047           | 85,764             | 3,074             |
| 2000 | 4,380,499          | 230,971           | 88,681             | 3,030             |
| 2001 | 4,311,044          | 242,524           | 91,779             | 3,702             |
| 2002 | 4,430,974          | 323,427           | 97,062             | 5,894             |

Source: U.S. Bureau of Labor Statistics web site. Retrieved on October 18, 2003 from <http://www.bls.gov/lau/home.htm>

- (a) What were the unemployment rates:
  - (a) in New York City for (i) 1996 and (ii) 2002?
  - (b) in Greeley for (i) 1996 and (ii) 2002? Show work. (8 points)
- (b) In December, 2002, the Greeley *Tribune* reported that the unemployment rate in Greeley had increased 30% since 1996 but that we were in much better shape than other places, such as New York City. Meanwhile, the *New York Times* reported that unemployment in New York City had gone down by 10% since 1996. Show work to demonstrate that the mathematics in both reports is, in fact, correct. (6 points)

**Part III.** Answer **TWO**, check the boxes of the two you are answering. Please write work and answer on other paper. Start each on a new sheet. Nothing written on this page for these problems will be graded (nope, no extra credit for doing more than two of these; 20 points each).

- Assume 2003 values for personal exemption, standard deductions, and marginal tax rates (the 2003 table of marginal tax rates is attached).
  - (a) Lee and Ken are married and file jointly. Their wages in 2003 were \$64,000. They earned \$377 in taxable interest on their savings account. They contributed \$7,500 to tax-deferred retirement plans. If they take the standard deduction, how much income tax will they owe? Show work to indicate: *gross income*, *adjusted gross income*, *taxable income*, and *calculation of tax owed* (12 points).
  - (b) Kai is a single parent, head of household, with one child (Amy). Kai's *taxable income* was \$37,000 in 2003. Kai gets an additional tax credit of \$500 for Amy. How much income tax will Kai owe? Show work to indicate *calculation of tax owed* (8 points).
- Hack and Quill race 200 meters and Hack wins by 10 meters. They race a second time, with Hack starting 10 meters behind the starting line. Who wins the second race? Draw a diagram to illustrate your solution and carefully explain how you justify your answer.

- Suppose your credit card balance is \$3,850. The company charges 20.9%, compounded daily. If you make no new charges, how much would you have to pay each month to pay off the credit card in one year? Show pertinent work and explain how you arrived at your answer.

- Shown below are a student's two attempted solutions for the problem:

Breanna needs to cover a 3 foot by 5 foot bulletin board with orange paper. The paper comes 8.5 by 11 inch sheets. Assuming she will cover the board without overlapping pieces of paper, how many sheets of paper will she need?

There is at least one mistake in one of the solution attempts.

- (a) Identify the mistake.
- (b) Explain why the solution attempt is wrong.

1<sup>st</sup> solution attempt

$$3ft \times 5ft = 15ft$$

$$8.5 \times 11 = 93.5$$

$$93.5 / 15 = 6.2333...$$

**She will need at least seven sheets of paper (6 plus some).**

2<sup>nd</sup> solution attempt

$$3' \times 5' = 15 \text{ ft}^2$$

$$93.5 \text{ in}^2 \left( \frac{1 \text{ ft}}{144 \text{ in}^2} \right) \approx 0.65 \text{ ft}^2 / \text{sheet}$$

$$15 \text{ ft}^2 \left( \frac{1 \text{ sheet}}{.65 \text{ ft}^2} \right) \approx 23.08 \text{ sheet}$$

She will need at least 24 sheets of paper.

- Consider the following table comparing the grade point average (GPA) and mathematics SAT scores of high school students in 1988 and 1998.

| GPA             | % of students |      | SAT Math Score |      |        |
|-----------------|---------------|------|----------------|------|--------|
|                 | 1988          | 1998 | 1988           | 1998 | Change |
| A+              | 4             | 7    | 632            | 629  | -3     |
| A               | 11            | 15   | 586            | 582  | -4     |
| A-              | 13            | 16   | 556            | 554  | -2     |
| B               | 53            | 48   | 490            | 487  | -3     |
| C               | 19            | 14   | 431            | 428  | -3     |
| Overall average |               |      | 504            | 514  | +10    |

Cited in *Chance*, Vol. 12, No. 2, 1999, from data in the *New York Times*, 9/2/99.

- (a) Make a single graphical display for the data. You may choose any graphic type that you feel is appropriate to the data set (5 points).
- (b) In general terms, how did the SAT math scores of the students in the five grade categories change between 1988 and 1998? (5 points).
- (c) How did the overall average SAT math score change between 1988 and 1998? (5 points).
- *USA Today* reports that drunken driving by high school seniors has declined. The report was based on two studies. In 1984, 31.2% of high school seniors reported driving after drinking sometime in the previous two weeks. By 2004, only 19.1% of high school seniors reported driving after drinking sometime during the previous two weeks. Discuss at least two pieces of crucial information that are missing and what more you would want to know before you accepted the reported conclusion.