

**You may work in pairs or purely individually for this assignment.** Prepare your answers to the following questions in a plain ASCII text file or MS Word document. Submit your file to the Curator system by the posted deadline for this assignment. No late submissions will be accepted. If you work in pairs, list the names and email PIDs of both members at the beginning of the file, and submit your solution under only one PID. No other formats will be graded.

For this assignment, you may (and are encouraged to) work in pairs; if you do so, you must also write your solutions in such a way that it is clear how each member contributed to deriving the solution.

You will submit your answers to the Curator System ([www.cs.vt.edu/curator](http://www.cs.vt.edu/curator)) under the heading OOC05.

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**For each question below, the quality of your explanation of how you derived the answer will carry as least as much weight as whether you've stated a correct solution. For each problem, apply one of the heuristics discussed in the course notes, and explain how you applied it.**

1. [20 points] Solve the following cryptarithm. Explain exactly how you deduced the solution.

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      TELL
      TALE
      TELL
      TALE
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      LATE

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Remember that each letter stands for a different digit (base-10), and that there are no leading zeros.

2. [20 points] Solve the following classic puzzle from Sam Loyd (1841-1911). Explain your logic clearly.

Here is a puzzle known as the Covent Garden Problem, which appeared in London half a century ago, accompanied by the somewhat surprising assertion that it had mystified the best mathematicians of England:

Mrs. Smith and Mrs. Jones had equal number of apples but Mrs. Jones had larger fruits and was selling hers at the rate of two for a penny, while Mrs. Smith sold three of hers for a penny.

Mrs. Smith was for some reason called away and asked Mrs. Jones to dispose of her stock. Upon accepting the responsibility of disposing her friend's stock, Mrs. Jones mixed them together and sold them of at the rate of five apples for two pence.

When Mrs. Smith returned the next day the apples had all been disposed of, but when they came to divide the proceeds they found that they were just seven pence short, and it is this shortage in the apple or financial market which has disturbed the mathematical equilibrium for such a long period.

Supposing that they divided the money equally, each taking one-half, the problem is to tell just how much money Mrs. Jones lost by the unfortunate partnership?

3. [20 points] A 32-page newspaper (think of a larger Collegiate Times) consists of 8 full sheets of newsprint. One of these sheets is selected at random, and the four page numbers that appear on it are added together. Can you determine the resulting sum? If so, what is it, and why?

4. [20 points] The CSI team has discovered a body in a storage unit whose interior dimensions are 10 feet by 10 feet by 10 feet. Due to the maturity of the corpse, there are 2001 flies inside the storage unit. Prove that, at any moment, there must be a group of three or more flies that would fit inside a sphere with radius 1 foot.
  
5. [20 points] The two-player game of Pargoo begins with two piles of small stones, one with 15 stones, and one with 20 stones. On each turn, the current player must choose a pile of stones and divide it into two nonempty smaller piles. Aside from the rule that a pile may not be empty, there are no restrictions on how many stones may be in each of the piles a player creates. The loser is the player who cannot carry out a valid move.

What strategy, if any, can the player who goes first use to guarantee that he wins? What strategy, if any, can the player who goes second use to guarantee that she wins?