This is a purely individual assignment. Prepare your answers to the following questions in a plain ASCII text file or a Word document. No other formats will be graded. Submit your file to the Curator system by the posted deadline for this assignment. No late submissions will be accepted without special permission from your instructor.

You will submit your answers to the Curator System (www.cs.vt.edu/curator) under the heading `OOC04`.

**1.** [10 points each] For each part, identify and carefully describe a definite relationship between figures **X** and **Y**. Then consider figure **Z** and choose a figure from **1**-**5** that has the same relationship to **Z** that **Y** has to **X**.

a)


b)


c)


2. [10 points each] For each part, describe an analogic relationship between the given pair of words by stating a relationship sentence (see the notes), and choose a pair of words from the given list of candidates that the most accurately possesses the same relationship. (It is perfectly acceptable for you to consult a dictionary if you like.)

a) EXPAND : VOLUME

ascend : flight
proliferate : number
bend : flexibility
cool : temperature
deflect : heading

b) MUTTER : INDISTINCT

demand : obedient
plead : obligatory
flatter : commendable
drone : monotonous
confirm : proven

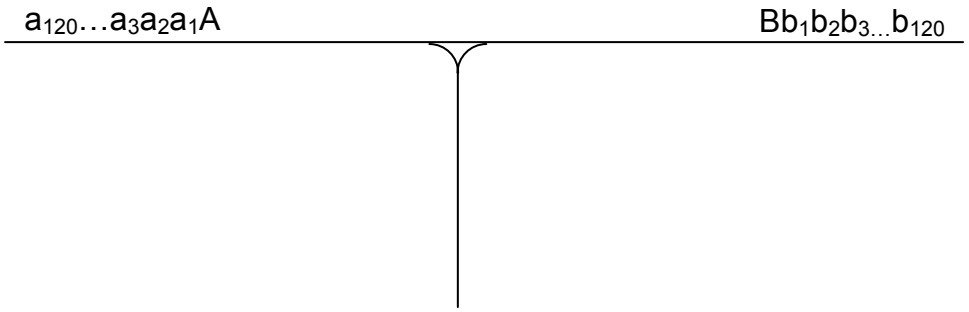
c) PEST : IRKSOME

salesclerk : courteous
expert : proficient
enigma : unexpected
leader : nondescript
accuser : indicted

**3.** [20 points] The two-player game of Partito begins with three piles of small stones, one with 8 stones, one with 13 stones, and one with 21 stones. On each turn, the current player must choose a pile of stones and divide it into two 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?

**4.** [20 points] Two trains, each consisting of an engine and 120 cars, must pass on a single track, with a dead-end siding as shown below. The siding can hold, at most, a single engine and 40 cars. Engines can move forward and backward, as far as necessary, and cars can be decoupled and recoupled, but in the end, the cars that make up each train must be in the same relative order as when the trains met, and the engines must be at the front of the trains. Note: it would almost certainly be good to include diagrams in your answer.




In other words, the goal is to achieve the following state: