MAT 511 Fundamental Concepts of Math

Problem Set 1
due Thursday, Sept 11

Please prove all your answers. Short and elegant proofs are encouraged but not required.

Problem 1. To win Portia's hand, her suitors must find her portrait hidden in one of the three caskets of gold, silver, and lead.

(a) Each casket has an inscription, as follows:
    GOLD: The portrait is here
    SILVER: The portrait is not here
    LEAD: The portrait is not in the gold casket
Portia tells her suitors that no more than one of the inscriptions is true. Find the portrait.

(b) This time, the inscriptions are as follows:
    GOLD: The portrait is here
    SILVER: The portrait is not here
    LEAD: The portrait is not in the silver casket
Portia says that at least one of the inscriptions is true, and at least one is false. Find the portrait.

Problem 2. Suppose you are investigating a robbery, and have arrived at the following conclusions:

1. The suspects are A, B, and C.
2. If A is guilty, he had exactly one accomplice.
3. If B is not guilty, then C is not guilty.
4. If exactly two suspects are guilty, then A is one of them.
5. if C is not guilty, then B is not guilty.

Using 1-5, determine who committed the robbery.

Problem 3. The inhabitants of an island can be Knights, Knaves, or Normals. Knights always tell the truth, Knaves tell only lies, and Normals can tell both truth and lies. A and B, who live on this island, make the following claims.
    A: B is a Knight
    B: A is not a Knight
Prove that at least one of them tells the truth, but that person is not a Knight.

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Please also do questions 9(a,f) of §1.2, 7(i,l) and 11(b) of §1.4 of *Eggen, Smith, St.Andre.*

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Also, solve (or read the solutions of) 11(a,c) §1.4; do not hand in this question.