**MATH.3860**
**Prob and Stats – Test 1 Spring 18 Name:** _____

1. (20 points) Events $A$ and $B$ are independent events with $P(A) = .7$ and $P(B) = .2$,
   (a) What is $P(A \cap B)$?
   (b) What is $P(A \cup B)$?
   (c) What is $P(A^c \cup B^c)$?
   (d) If $P(D) = .8, P(E) = .5$ and $P(D \cup E) = .9$, are $D$ and $E$ independent events? Why or why not?

   *.14; .76; .86; indep*

2. (20 points) The *Enterprise* is considering launching a surprise attack against the Borg. According to Data's calculations the probability of Klingons joining forces with the Borg is 0.2384. Captain Picard feels the probability of the attack being successful is 0.8 if the *Enterprise* can catch the Borg alone, but only 0.3 if they have to engage both adversaries. Data claims the mission would be a tactical misadventure if the probability of success were not at least 0.7306. Should the *Enterprise* attack?

   $P(success) = .6808$*, so they should not attack*

3. (20 points) During a power blackout, 100 persons are arrested on suspicion of looting. Each is given a polygraph test. Past experience has shown the polygraph is 90% reliable when administered to a guilty suspect and 98% reliable when given to someone who is innocent. Suppose that of the 100 persons taken into custody, only 12 were actually involved in wrongdoings. What is the probability that a given suspect is innocent given that the polygraph says he is guilty?

   *approx .163*

4. (20 points) The gunner on a small assault boat fires 6 missiles at an attacking plane. Each has a 20% chance of being on target. If two or more of the shells find their mark, the plane will crash. At the same time, the pilot of the plane fires 10 air-to-surface rockets, each of which has a 0.05 chance of critically disabling the boat. Would you rather be on the plane or on the boat? Justify your answer with the appropriate probability calculations.

   *The prob of plane crash is* $1 - (.8)^6 - 6(.2)(.8)^5 = 0.345$*. The prob of disabling the boat is* $1 - (.95)^{10} = .401$*.*

5. (10 points) To qualify as a "one-pair" hand in a five card poker hand, the five cards must include two of the same denomination and three "single" cards — cards whose denominations match neither the pair nor each other. Compute the probability that a random poker hand gives a one pair hand.

   $P(pair) = 0.42$

6. (10 points) If men constitute 47% of the population and tell the truth 78% of the time, while women tell the truth 63% of the time, what is the probability that a person selected at random will answer a question truthfully?

   $(.43)(.78) + (.57)(.63)$