Name: _____

Exam # 2 – STA 2023H – Summer 2011

Recall that given a binomial distribution, if n is the number of attempts, p is the probability of that an attempt succeeds, then the probability that in n attempts one succeeds k number of times is given by the formula.

$$P(X = k) = \binom{n}{k} p^k (1-p)^{n-k}.$$

A binomial distribution is a normal distribution $N(np, \sqrt{np(1-p)})$.

1. What does it mean for the events A and B to be independent?

2. Suppose you choose 5 cards at random from a standard deck of card. What is the probability that you draw a full house (that is, a three-of-a-kind and a pair)? Explain each number that you get.

   (a) What is the size of the sample space?

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   (b) Finish the problem. Find the probability. Show work and don't just give a number. Explain your steps. Use the back of the page if necessary.

3. Suppose you have 47.4% percentage of winning a game. You play the game 10 times. (Show work.)

   (a) What is the probability that you win 6 times?

   (b) What is the probability that you win no more than 2 times?

4. You roll three dice and sum up the faces. What is the probability that your sum is 7? Show work.

5. The scores on an exam are given by the normal distribution N(500; 100) what is the probability that a person scored a 635 or higher? Show work.

6. You have a sequence of 40 digits long. The probability of having exactly four 0s is about:
   a) .0000225 b) .0225 c) .2059

7. You have a sequence of 40 digits long. The mean number of 0s is:
   a) 4 b) 10 c) 20

8. A striking trend in higher education is that more women than men reach each level of attainment. Here are the counts (in thousands) of earned degrees in the United States in 2010-2011 academic year, classified by level and by the sex of the degree recipient:

	Bachelor′s	Master′s	Professional	Doctorate	Total
Female	986	411	52	32	
Male	693	260	45	27	
Total					

   (a) Fill in the Totals row and Totals column.
   (b) If you choose a degree at random, what is the probability that the person you choose is a woman?

   (c) What is the conditional probability that you choose a woman, given that the person received a doctorate?

   (d) Are the events "choose a woman" and "choose a doctoral degree recipient" independent? How do you know?

Julie is graduating from College. She has studied biology, chemistry, and computing and hopes to use her science background in crime investigation. Late one night she thinks about some jobs for which she has applied. Let A, B, and C be the events that Julie is offered a job by

$$A = \text{ the Palm Beach Office of the Chief Medical Examiner}$$

$$B = \text{ the Miami Division of Crimial Justice}$$

$$C = \text{ the federal Disaster Mortuary Response Team}$$

Julie writes down her personal probabilities for being offered these jobs:

$$\begin{array}{ccc} P(A) = 0.6 & P(B) = 0.4 & P(C) = 0.2 \\ P(A \text{ and } B) = 0.1 & P(A \text{ and } C) = 0.05 & P(B \text{ and } C) = 0.05 \\ P(A \text{ and } B \text{ and } C) = 0 & & \end{array}$$

Fill in the Venn Diagram (from the board) with the probabilities onthe back of page 3. There should be 8 numbers.

(a) What is the probability that Julie is offered at least one of the three jobs (so either A or B or C)?

(b) What is the probability that Julie is offered both the Miami and Palm Beach jobs?

(c) If Julie is offered the federal job, what is the conditional probability that she is also offered the Palm Beach job?

9. A player serving in tennis has two chances to get a serve into play. If the first serve is out, the player has a second serve. If the second serve is also, the player loses the point. Here are the probabilities based on four years of Wimbledon Championship

$$\begin{aligned} P(\text{ 1st serve in }) &= 0.59 \\ P(\text{ win point } | \text{ 1st serve in}) &= 0.73 \\ P(\text{ 2nd serve in } | \text{ 1st serve out }) &= 0.86 \\ P(\text{ win point}|\text{1st serve out and 2nd serve in }) &= 0.59 \end{aligned}$$

Draw a tree diagram. What is the probability that the serving player wins the point?