Math 1312 – test II – Review

1. Let \( E \) be any event of some sample space \( S \).
   a) If \( E \) is an impossible event, then \( P(E) = \) _______
   b) If \( E \) is a certain event, then \( P(E) = \) _______

2. If \( S = \{ s1, s2, s3 \} \) with \( P(s1) = 1/5, \ P(s2) = 1/5 \), then does \( S \) have uniform probability? Why or why not?

3. If \( A \) and \( B \) are independent with \( P(A) = 0.2 \) and \( P(B) = 0.5 \), then
   a) \( P(A | B) = \) _______
   b) \( P(A \cap B) = \) _______
   c) \( P(A \cup B) = \) _______

4. If \( A \) and \( B \) are mutually exclusive with \( P(A) = 0.2 \) and \( P(B) = 0.5 \), then
   a) \( P(A | B) = \) _______
   b) \( P(A \cap B) = \) _______
   c) \( P(A \cup B) = \) _______

5. Five cards are drawn at random from a standard deck of cards, what is the probability that
   a) all are diamonds
   b) at least one is a diamond
   c) exactly three are diamonds

6. A club is to select a President and a VP from a group of 20. Among the 20, there is a husband and wife. What is the probability that they are selected to serve as leaders of this group.

7. A weather person is wrong 8% of the time. We observe the accuracy of this person each Monday during the next eight weeks. What is the probability that the weatherperson will be right
   a) all eight days
   b) exactly 2 days (answer to the nearest hundredth)
   c) at most 7 days (answer to the nearest hundredth)
8. Simplify each of the following.
   a) factorials:
      \[ 
      900! \div 899! = _________ \\
      n \cdot (n - 1)! = _________ \\
      (n+1)! / (n-1)! 
      \]

   b) combinations:
      \[ 
      \binom{n}{r} = _________ \text{ formula} \\
      \binom{n}{r} = \binom{n}{s} \text{ (when ?)} _________ \\
      \binom{n}{1} = _________ \\
      \binom{n}{n} = _________ \\
      \binom{n}{0} = _________ 
      \]

   c) permutations
      \[ 
      \text{P}(n, n) = _________ \\
      \text{P}(n, 1) = _________ \\
      \text{P}(n, 0) = _________ 
      \]

9. Bernoulli experiment
   a) A Bernoulli experiment consists of how many outcomes? What are they called?

   b) \( n \) independent trials of a Bernoulli experiment is called a ? __________________________

   c) What is the binomial formula? ________________________

   d) A binomial (r.v) variable always measures the number of? ____________

10. Formulas:
    a) \( \text{P}(A \cup B) = \) __________________________

    b) \( \text{P}(A \cap B) = \) __________________________

    c) \( \text{P}(A | B) = \) __________________________

    d) Binomial formula: \( \text{P}(x \text{ successes}) = \) __________________________
11. Multiplication Principle

a) During half-time of a basketball game – 10 people are called down to the floor. Of these 10 people 3 will be selected for a drawing – two will a t-shirt and the third one will win a t-shirt, $50 and a chance at a million dollar (a shot from midcourt). It is estimated that a person has a 1 in 1000 chance of making the shot.

IF you are one of the 1000 people watching the game (at the game), then what is the probability that you will end up making the million dollar shot.

b) A committee of four is to be chosen; one from each department. The sales department has 4 male and 1 female member. The accounting department has 2 male and 1 female accountants. The service group has 3 male and 2 female workers. The business office has 4 male and 6 female members.

How many different groups are possible? ____________ What is the probability that all four are women? ______

c) Five letter words are to be created using the letters in the set \{ a, b, c, d, e, i, o, u \}. How many five letter words are possible – (do not have to make sense) if

1) repetitions are allowed? ____________

2) repetitions are not allowed? ________

d) A four digit number is to be created using the digits \{ 1, 2, 3, 4 \}. What is the probability that the number will be greater than 3000 if

1) repetitions are not allowed? ____________

2) repetitions are allowed? ________________

12. It takes three points to make a triangle. Seven points are drawn on a sheet of paper – no three points form a line. How many different triangles could you draw by connecting the dots?

13. It takes two people to make a handshake. A room is filled with 20 politicians. If everybody shakes hands with everybody (except themselves), how many different handshakes are possible?

14. A group of 3 is to be selected from a class of 21. The first person gets an A in the class and $20. The second one gets $20 only. The third person gets to erase the board. How many different groups of three are possible?
15. A 12 sided fair die is rolled four times. What is the probability that you will roll twelve identical rolls?

16. A group of three students are to be selected from a class of 20 students. They are to write down the solution to three different problems on the board (one per student). A student may or may not know the solution to a particular problem so it will matter whether the student is picked first, second, or third. How many different selections are possible?

17. A group of 2 men and 3 women walk into a room. What is the probability that the men will walk in first and last?

18. Five employees are asked to show up to work on Saturday. It is a voluntary assignment. What is the probability that all will show up? Assume that each one will make up their mind at random.

19. A sample of 20 employees indicates that 12 have a college degree and 8 do not. If a person has a college degree, they have a probability of 0.7 of being happy at the workplace. If a person does not have a college degree, then they have a probability of 0.4 of being happy at the workplace.

A person is selected at random from one of these 20 individuals. What is the probability that
a) the person is unhappy if they are known not to have a degree? ________________

b) the person is not happy? ________________

c) has a degree and is not happy? __________

d) has a degree if they are known not to be happy? _______________

20. Five cards are drawn from a standard deck. What is the probability that you will have a hand that consists of two aces, two face cards, and one six?

21. A student is planning to take a test on Saturday. No pencils or other writing utensil will be available. He takes four pencils with him and each one has a probability of 0.2 of breaking – at which point they can not be fixed. What is the probability that the student will be able to finish the test.

22. A recent graduate is applying to three different jobs. The probability that he gets hired at the first job is 0.4, the second one is 0.3, and the third one is 0.2

What is the probability that he gets at least one job offer?
23. Find the arithmetic mean, mode, median of
   a) 3, 0, 0, 2, 6, 1
       mode = ________  median = ___________  mean = ________
   b) 12 occurs with frequency 12
      8 occurs with frequency 30
      2 occurs with frequency 8
       mode = ___________  median = ___________  mean = ________

24. variance (population) and standard deviation of the data
   0, 0, 3, 1

25. sample mean and sample variance of
   
   2 with frequency 25
   5 with frequency 50
   8 with frequency 25

   HINT: the mean is 50.

26. random variable: three types what are they → ________________

       ________________

   Answers: to
   15. 6 / 6^12 = 1/6^11
   16. P(20, 3 ) = 20•19•18

   17. \[
       \frac{2 \cdot 3 \cdot 2 \cdot 1 \cdot 1}{5 \cdot 4 \cdot 3 \cdot 2 \cdot 1} = \]

   18. # of subsets = 32, P ( all show up ) = 1/32
   19. 0.6, 0.42, 0.18, 0.18/0.42 = 18/42 =
   20. C(4,2) • C(12, 2) • C(4, 2) / C (52, 5)

   22. 1 - (0.2)^4  
   23. 1 - (.6)(.7)(.8)