Statistics 213 Midterm Review

Note: Just because something is not asked on the review does not mean that it will not be asked on the Midterm!!

1. A psychologist has developed a new test of adult intelligence. The test was administered to 21 individuals and the following test scores were obtained:

   114 99 131 124 117 102 106 127 119 104 106
   115 98 144 151 132 106 125 122 118 118

   (From this data, $\Sigma x = 2478$, $\Sigma x^2 = 296388$)

   (a) Present this data in a stem and leaf plot (with ordered leaves and a leaf unit of one).
   (b) How would you describe the shape of this distribution?
   (c) Calculate the values of
      (i) the central measure (mean, median and mode).
      (ii) the measure of dispersion (range, variance, and IQR).
      (iii) Which central measure would you use to represent the "centre" of the data and why?
      (iv) Which measure of dispersion would you use to represent the data?

   (d) Draw a "modified" boxplot of this data. Include a scale on which the values of the quartiles, fences, and any outliers are carefully labelled. Show any relevant calculations.
   (e) If there had been 2100 individuals in the sample and you had wanted to describe the shape of the distribution, what procedures would you have used?
   (f) Group the data as 90-100, 100-110, 110-120, 120-130, 130-140, 140-150, 150-160.
   (g) Describe the shape of the distribution

2. A sample of 100 values has a mean of 20 and a standard deviation of 4. The shape of the distribution is unknown. How many values would you expect to be contained in the interval 11 to 29. (80.25)

3. The empirical rule indicates that we can expect to find what proportion of the sample between the following?

   (a) $\bar{x} - s$ and $\bar{x} + s$
   (b) $\bar{x} - 2s$ and $\bar{x} + 2s$
   (c) $\bar{x} - 3s$ and $\bar{x} + 3s$

4. A manager must choose 5 secretaries from among 12 applicants and assign them to different stations.
   (a) How many different arrangements are possible?
   (b) If the selections are random, what is the probability of getting the 5 youngest secretaries selected in order of age

5. Consumers rate customer service at a local McDonalds as 1=excellent, 2= good, 3 = fair, 4= poor. Assuming that customers are independent, suppose they randomly pick 6 customers.
   (a) How many different outcomes are possible?
   (b) What's the probability of having 5 people rate the service as excellent? (1/95040)

6. In a survey of college freshmen, 76% stated that getting a better job was very important in their decision to attend college. If three different freshmen are randomly selected, find the probability that at least one indicated a better job as being very important in the decision to go to college. (.9862)

7. A game of chance is considered **fair** if a player's expectation is equal to zero. If someone pays me $10 each time I roll a 3 or 4 with a balanced die, how much should I pay them when I roll a 1,2,5, or 6 to make the game fair? ($5)

8. In a survey of randomly selected adults, 150 were ticketed for speeding and 140 others received parking ticket during the last year. In this group, none received both. Men received 100 of the speeding tickets and 90 of the parking tickets.
   (a) Find the probability of selecting a woman (.3448)
   (b) Find the probability of selecting a woman or someone ticketed for speeding. (.6897)
   (c) Find the probability of selecting a woman or someone ticketed for parking. (.6552)
   (d) Find the probability of not selecting a woman given that they have a speeding ticket. (.6667)
   (e) Find the probability of not selecting a woman with a parking ticket. (.8276)
   (f) If an individual is a man, what is the probability of him having a speeding ticket? (.5263)
   (g) Is sex and the type of ticket given independent? Show using values.

9. A car dealer has sold 100 delivery vans that are still under warranty. The probability that any of these vehicles will break down on any given day and require warranty service is 0.02. The dealer is proud of his service because all warranty work is completed the same day. He keeps three courtesy vans for customers whose vehicles are being repaired.

   (a) Show the expression for the exact probability that the dealer will be short of courtesy vans on any given day.
   (b) What is the expected number and variance in the number of vehicles requiring warranty service on any given day? (2), (1.96)
   (c) A small delivery business has ten of these vans. If all vehicles are used, find the probability that, on any given day, at least one will break down. (0.1829)
   (d) Today an Arctic front suddenly dropped temperatures overnight to -50°C. Unknown to the delivery company dispatcher, three vehicles of the ten mentioned in c) are in very bad shape, will not even start and will require immediate warranty service. If he chooses randomly five vans for today's deliveries, what is the probability that at least one chosen van will not start? (11/12)
   (e) Before delivering a new vehicle to the customer, the dealer performs a complete vehicle inspection. Ninety-nine percent of new vehicles pass this inspection. A large shipment of new vehicles has just arrived from the factory. The service technician can test only three vehicles today and the rest of the shipment will be inspected tomorrow. What is the probability that the first vehicle, which does not pass the inspection, will be discovered today? (0.0294)

10. Peter Parker offers to pay you a dollar for each spot that appears on the surface of a die in a single toss. The price charged by Peter for each roll of the die is $3.00. Would you want to play? (yes, because you will make 50 cents on average)

11. The probability that a sharp shooter hits a target with any single shot is 0.6. Assume the shots are independent.

   (a) What is the probability that his second shot missed the target? (0.4)
   (b) What is the probability that four consecutive shots miss the target? (0.0256)
   (c) What is the probability of at most one miss in four consecutive shots? (0.4752)
   (d) What is the probability that his fourth shot is his second miss? (0.1728)
   (e) If his fourth shot is a miss, what is the probability that he has at least two misses in his first four shots? (0.784)

12. Hotels often have an over-booking policy. Assume the "no-show" rate at a hotel is 10% - that is, a customer with a reservation, independently of any other customer, cancels the reservation at the last minute or simply does not appear with a probability of 0.10. There are 200 available rooms in this hotel. If the hotel makes 215 reservations for a particular night,

   (a) what is the expected number of "no-shows"? (21.5)
   (b) What is the probability that the hotel has at least 10 empty rooms on that night? (.2425)
   (c) What is the probability that at least one customer with a reservation will not have a room? (0.0496)

13. The probability that a person suffering from migraine headache will obtain relief with a particular drug is 0.98. Three randomly selected sufferers from migraine headache are given the drug. Find the probability that the number obtaining relief will be

(a) exactly 0. (0.000008)
(b) exactly one. (0.00118)
(c) more than one. (0.9988)
(d) two or fewer. (0.0588)

14. Bill has a 90% chance of remembering to mail a letter to a friend. If he mails the letter, there's a 99% chance that it will be picked up. If it's picked up, there's a 95% chance that it will get delivered.
    (a) What's the probability that the friend never receives the letter?
    (b) If the friend never gets the letter, what's the probability that Bill mailed it but it was never picked up?

15. Of 120 auto ignition circuits, there are 18 defects. If two circuits are randomly selected, find the probability that they are both defective in each case.
    (a) The first selection is replaced before the second selection is made.
    (b) The first selection is not replaced.

16. The probability that Ms. Brown will sell a piece for property at a profit of $3000 is 3/20, a profit of $1500 is 7/20, break even is 7/20, and the probability that she will lose $1500 is 3/20. What is her expected profit? ($750)

17. A average of 3 cars arrive at a highway tollgate every minute. Assume that arrivals are independent. Find the probability that
    (a) exactly 5 cars will arrive in a 1 minute period. (.1008)
    (b) at least 2 cars will arrive in a 1 minute period . (.1991)
    (c) exactly 200 cars will arrive in a 1 hour period. (.00965)