DeVry University Spring 2004

Math 191: Probability & Statistics Exam #2A

Week #10

Name:___________________

INSTRUCTIONS: You may use a calculator for this exam and a letter-sized study sheet with information written on a single side. You must show all of your work in order to receive full credit. Read each question carefully. Be certain that you have answered the question that was asked. Answers supplied as decimals must be accurate to *at least four decimal places.*

Problem	Points	Score
1	20	
2	20	
3	20	
4	20	
5	20	
EC	10	
Total	100	

(1) Data is collected regarding the Blood Type (O,A,B and AB) and Rh Factor (positive or negative) of 1000 people in the United States. The results are listed below

	Blood Type				
Rh	**O**	**A**	**B**	**AB**	**Total**
positive	378	348	90	34	
negative	67	55	22	6	
Total					

(a) Fill in the margins (totals) of the table provided.

(b) What is the probability that a random donor in this group will have type A blood **given** that she is Rh-positive?

(c) What is the probability that a random donor in this group will be Rh-negative if we already know that she has type AB blood?

(d) Does "having type AB" and "being Rh-positive" represent **independent** events? Explain your answer.

(2) Motor Vehicle Services administers a written driving test to all applicants containing 25 multiple-choice questions. Each question has 4 possible choices, only one of which is correct. Josh becomes confused when he sees the test and starts answering each question randomly.

(a) For a specific question, what is the probability that he will answer it correctly?

(b) What is the probability that he will get **a total** of 6 answers correct?

(c) On average, how many problems would Josh get right? What would the variance be?

(d) What is the probability that he will guess correctly **for the first time** on the sixth question?

(e) On average, when will he choose correctly for the first time?

(3) Given that the switchboard at DeVry receives on the average 0.7 calls per minute, find the probabilities that

(a) in a given minute there will be **at least one call**,

(b) in a **5-minute interval** there will be exactly 4 calls.

(4) Extruded plastic rods are automatically cut into nominal lengths of 7 inches. Actual lengths are normally distributed about a mean of 7 inches with a standard deviation of 0.05 inches.

(a) What proportion of the rods will be shorter than 6.94 inches?

(b) What proportion of the rods will exceed the tolerance limits of 6.88 inches to 7.12 inches?

(c) 93% of the rods will be shorter than how many inches?

(5) In certain experiments, the error made in determining the density of a silicon compound is a **uniform** random variable with a probability density $f(x)$ of

$$f(x) = \begin{cases} 25 & \text{for } -0.02 < x < 0.02 \\ 0 & \text{otherwise} \end{cases}$$

(a) Find the probability that such an error will be between -0.013 and 0.009.

(b) What is the random variable's mean μ, variance σ^2, and standard deviation σ?

EXTRA CREDIT!! The **exponential distribution** describes a situation where you track the waiting time until a certain event occurs such as the decay of a radioactive particle or entrance of the next customer to a store. You are supplied with a single parameter τ representing the **average waiting time** between events. The probability density $f(t)$ and the distribution function $F(t) = P(X \leq t)$ are given by the formulas

$$f(t) = \begin{cases} \frac{1}{\tau}e^{-\frac{t}{\tau}} & t > 0 \\ 0 & \text{otherwise} \end{cases}, \text{ and } F(t) = \begin{cases} 1 - e^{-\frac{t}{\tau}} & t > 0 \\ 0 & \text{otherwise} \end{cases}$$

Now consider the following situation. The amount of time that a surveillance camera will run without having to be reset is an **exponentially distributed** random variable with an average waiting time τ of 40 days. What are the probabilities that such a camera

(a) will have to be reset within 30 days?

(b) will **not** have to be reset for at least 50 days?