Sample Exam 3 Problems

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Warning. This "practice" exam is longer than a normal 50 minute exam. This practice set was made longer in order that a wider variety of problems could be included. However, NO CLAIM is made that all types of exam problems are included in this practice set.

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1. Classify each of the random variables at continuous, infinite discrete, or finite discrete.

   X = the number of defective watches in a sample of 8 watches.

   Y = the distance a commuter travels to work measured to the nearest nanometer.

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2. The personnel department of the WeBeBig Bank has compiled the following data about income and education of their employees. Experiment: A person is chosen at random from among the employees.

   Let $CG = \{x|\ x\ is\ a\ \mathbf{C}ollege\ \mathbf{G}raduate\}$ $IL = \{x|x\ has\ an\ \mathbf{I}ncome\ \mathbf{L}arger\ than\ \$35,000\}$

	$Income \leq \$35K$	$Income > \$35K(\mathbf{IL})$	$Totals$
$Not\ a\ College\ Graduate$	2435	25	2460
$(\mathbf{CG})College\ Graduate$	670	870	1540
$Totals$	3105	895	4000

   i) Find $P(CG|IL)$

   ii) Find $P(CG \cap IL)$

   iii) Find $P(IL|CG)$

   iv) Find $P(IL \cup CG)$

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3. If the sports forecaster feels that the odds of a boxer winning the match are 4 to 3, what is the probability of winning the match?

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4. Your town has three weather men Jack, Zack and Mack. Let **J** **Z** & **M** denote the probabilities that **J**ack **Z**ack and **M**ack's weather reports are correct respectively. Assume that Jack, Zack, and Mack's weather reports are independent. $P(J) = .7, P(Z) = .9$ and $P(M) = .95$

   i) What is the probability that exactly two of the weather men are correct?

   ii) What is the probability that at least one of the weather men is correct?

   iii)What is the probability that Jack is the only one who is correct?

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5. The next set of problems use the following scenario. One-half of one percent (0.5%) of the population in the region has YIK. A test is given to new babies as soon as they are born which gives a positive result 99.8% of the time in people who have YIK. However, 2% of the time it gives a false positive result for people who do not have YIK.

   i)What is the probability that a baby selected at random will test positive?

   ii) It is known that a baby tested positive. What is the probability that the baby has YIK?

   iii) If a baby has YIK, what is the probability that the baby will test positive?

   iv) If the baby tests positive, the obstetrician has the baby tested again. Assume that the results of the second test are independent of those of the first test. Given that an infant tested positive twice what is the probability that the baby has YIK?

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6. The next set of problems use the following scenario. IQs are a normally distributed random variable with mean 100 and standard deviation of 15.

   i) About 50% of the population has an IQ above __________________________.

   ii) The percentage of the population with an IQ larger than 107 is __________________________.

   iii) Suppose that a private University wanted to restrict admission to students with IQ scores in the top 20%. What IQ would this University require for admission?

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7. Four dice are tossed. What is the probability that no two dice have the same number?

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8. Five people are sitting in a bar. What is the probability that at least two have the same Zodiac sign? (Assume that the twelve Zodiac signs are all equally likely.)

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9. A woman wishes to purchase a $50,000 term life insurance policy. the policy will protect her for 5 years. According to statistical tables, her probability of surviving for another 5 years is 97%. What would an insurance company selling 30,000 such policies have to charge per policy to break even. (Expected profit of zero.)

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10. *Independence and Mutual Exclusiveness*

The Experiment: Two balls are drawn WITHOUT replacement from an urn containing 5 red and 2 green balls.

R1 = the event that the first ball is red R2 = the event that the second ball is red

G1 = the event that the first ball is green G2 = the event that the second ball is green

Choose from among R1,G1, R2 and G2 to answer the following questions.

i) If possible, choose two events that are both mutually exclusive AND dependent ii) If possible, choose two events that are both mutually exclusive AND INdependent iii) If possible, choose two events that are NOT mutually exclusive but are dependent

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11. Of 600 tu students surveyed,

213 could count to 10

117 could sing the alphabet song and

48 could sing the alphabet song ONLY

74 could list all the colors

only 1 could do all three

162 could count to 10 but couldn't do anything else

15 could count to 10 and knew all the colors, but couldn't sing the alphabet song

281 couldn't do any of these things

A) Draw a Venn diagram describing this scenario.

B) Given that a student can list all the colors, what is the probability that he or she can count to 10?

C) What is the probability that a student can count to 10 AND list all the colors?

D) Given that a student can count to 10, what is the probability that he or she can list all the colors?

E) What is the probability that a student could do at least one of these tasks?

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12. *Independence and Mutual Exclusiveness*

The Experiment: Two balls are drawn WITH replacement from an urn containing 5 red and 2 green balls.

R1 = the event that the first ball is red R2 = the event that the second ball is red

G1 = the event that the first ball is green G2 = the event that the second ball is green

Choose from among R1,G1, R2 and G2 to answer the following questions.

i) draw a tree diagram illustrating this scenario

ii) If possible, choose two events that are both mutually exclusive AND dependent.

iii) If possible, choose two events that are both mutually exclusive AND INdependent.

iv) If possible, choose two events that are NOT mutually exclusive but are INdependent.

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13. $P(A) = .3$ and $P(B) = .5$ and $P(A \cup B) = .65$. Are A& B independent? Prove your answer.

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14. Give six numbers with a mean of zero and a standard deviation of -1 if possible.

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15. Give 6 numbers with a mean of zero and a variance of 4 if possible. (Hint: Variance is the average of the squared distances.)

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16. According to the pharmecutical company, the probability of side effects from a drug are 35%. you give the drug to 4 patients. Your random variable is the number of patients with side effects { 0,1,2,3,4 } . Find the probability distribution of the random variable.

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17. For the next problems assume that 4% of a certain population has a defective gene X.

    i) Find the probability that out of a sample of 1000 people, 50 or more have the defective gene. Use the normal appoximation to the binomial distribution. Your answer must be correct to three significant digits.

    ii) Sketch graphs of both the normal and binomial distributions from part i. (You won't be able to put in all the rectanges for the binomial distribution, but sketch at least 6 in strategic locations.) You must lable the mean. You must shade the area found in part "i". You must lable any upper and lower bounds on the x-axis.

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18. Find the mean, standard deviation, and variance of the following distribution.

X	3	4	9	10
p	.4	.3	.2	.1

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19. State the binomial formula

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20. What criteria must an experiment meet in order to be a binomial experiment.

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21. There are at least three different methods of finding $E(x) = \mu$

    i)$\mu = np$

    ii) $E(x) = \mu = x_1p_1 + x_2p_2 + x_3p_3 + \ldots + x_np_n$

    iii) Letting the calculator find it by putting all of your data in L_1 and L_2 , selecting *1-Var Stats* and reading off $\bar{x}$

    when would it be appropriate to use each method?

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22. Explain in your own words why sometimes when you are finding the area under the normal curve you add or subtract $\frac{1}{2}$ to the endpoints and sometimes you *don't* .

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Some sections of Math 166 will cover chapter 5, some will cover chapter 9, others will cover both. Check your syllabus to see which chapter(s) your section is covering, and how much of this will be on the third exam, how how much of this will only be on the final. Supplement this Exam with appropriate questions.