

**MATH 141**  
**Exam III Review Activity for**  
**Sections 7.4-7.6, and 8.1-8.6**

Name: KB

Place your group's final answers on your answer sheet.

1. A random variable,  $X$ , can only obtain the values 3, 4, 5, 6, 7, 8, or 9. A histogram of the probability distribution of  $X$  is given below.

(a) What type of random variable is  $X$ ?

Finite Discrete

(b) What is the expected value of  $X$ ?

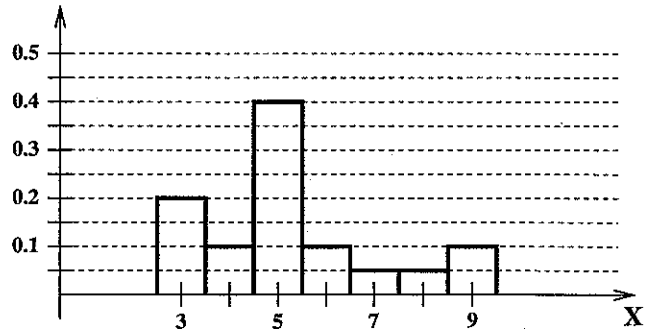
$$E(X) = 3(0.2) + 4(0.1) + \dots + 9(0.1)$$

or... 1-var stats  $L_1, L_2 \rightarrow \bar{x} = 5.25$

(c) What is the variance in  $X$ ?

1-var stats  $L_1, L_2$

$$(\sigma_X)^2 = 3.1875$$



$L_1$	X	3	4	5	6	7	8	9
$L_2$	prob	0.2	0.1	0.4	0.1	0.05	0.05	0.1

(d) What is the mode of  $X$ ?

5 (The  $X$ -value with the tallest rectangle; the  $X$ -value that occurs the most often.)

(e) What is the median of  $X$ ? 1-var stats  $L_1, L_2 \rightarrow \text{Med} = 5$

2. A fair coin is tossed 100 times. Use an appropriate normal distribution to approximate the probability (to four decimal places) that more than 20 but fewer than 40 heads show up.

Binomial

$X = \#$  of heads

$$n = 100$$

$$p = 1/2 \quad q = 1/2$$

$$\mu = np = 50$$

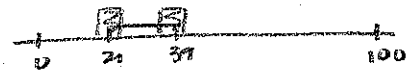
$$\sigma = \sqrt{npq} = 5$$

$$P(20 < X < 40) = ?$$

$$P(21 \leq X \leq 39)$$

$$\approx \text{normalcdf}(20.5, 39.5, 50, 5)$$

$$= 0.0179$$



3. In a binomial experiment, which one of the following statements must be TRUE? For any statement below which is not true, explain how to make the statement true.

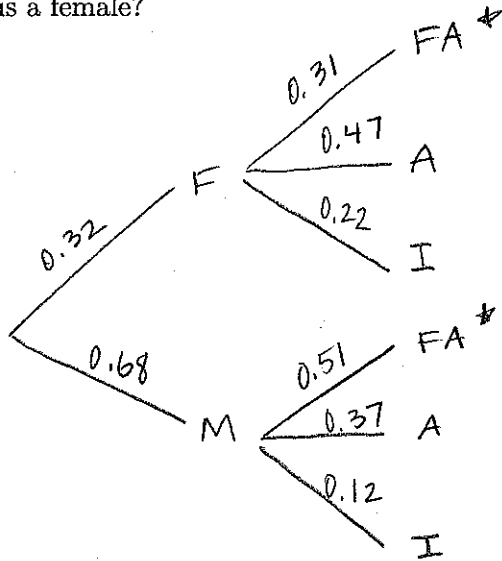
I. There are a fixed number of ~~dependent~~ <sup>independent</sup> trials.

II. The probability of failure  $\neq$  the probability of success.

The prob. of success is the same in every trial.

III. Each outcome is classified as either a success or a failure.

4. A study of the faculty at U.S. medical schools revealed that 32% of the faculty were women and 68% were men. Of the female faculty, 31% were full/associate professors, 47% were assistant professors, and the rest were instructors. Of the male faculty, 51% were full/associate professors, 37% were assistant professors, and the rest were instructors. If a faculty member at a U.S. medical school selected at random holds the rank of full/associate professor, what is the probability that she is a female?



$$\begin{aligned}
 P(F | \overleftarrow{FA}) &= \frac{P(F \cap \overleftarrow{FA})}{P(\overleftarrow{FA})} \\
 &= \frac{0.32(0.31)}{0.32(0.31) + 0.68(0.51)} \\
 &= \boxed{\frac{248}{1115}}
 \end{aligned}$$

5. The standard normal random variable,  $Z$ , has a mean  $\mu = 0$  and standard deviation  $\sigma = 1$ .

6. Given two events of an experiment,  $A$  and  $B$ , where  $P(A) = 0.2$  and  $P(B) = 0.7$ , find  $P(A \cup B)^c$  if

DO NOT INTERSECT

(a)  $A$  and  $B$  are mutually exclusive.  $P(A \cup B)^c = 1 - P(A \cup B)$

A	B
0.2	0.7
0.1	

$$\begin{aligned}
 &= 1 - 0.9 \\
 &= \boxed{0.1}
 \end{aligned}$$

(b)  $A$  and  $B$  are independent.

$P(A \cap B) = P(A)P(B) = 0.2(0.7) = 0.14 \rightarrow b = 0.14$

A	B
0.06	0.56
0.14	
0.24	

$$\begin{aligned}
 P(A \cup B)^c &= \boxed{0.24} \\
 a + b &= 0.2 \rightarrow a = 0.06 \\
 b + c &= 0.7 \rightarrow c = 0.56 \\
 a + b + c + d &= 1 \rightarrow d = 0.24
 \end{aligned}$$

7. Let  $X$  be a normal random variable with a mean of 40 and a standard deviation of 3. Find  $a$  (rounded to four decimal places) such that  $P(X \geq a) = 0.3529$ .

$1 - 0.3529$

0.3529

|||||

a

$$\begin{aligned}
 a &= \text{invNorm}(1 - 0.3529, 40, 3) \\
 a &\approx \boxed{41.1325}
 \end{aligned}$$

8. For the following two scenarios, decide which row of information represents the random variable,  $X$ , being measured.

(a) A survey of students was conducted regarding the number of songs they download each week.

# of students	3	4	5	6	7
# of songs	1	2	3	4	6

Circle the variable being measured,  $X$ : # of students    # of songs

(b) A survey of police officers was conducted regarding the number of doughnuts eaten by an individual officer during the morning shift.

# of doughnuts	1	2	3	4	5
# of officers	5	6	9	10	11

Circle the variable being measured,  $X$ : # of doughnuts    # of officers

9. The probability that a CD player produced by MathMusic is defective is estimated to be 0.2. If a sample of 15 CD players is selected at random, what is the probability (rounded to four decimal places) that the sample contains at least 2, but less than 6 working CD players?

Binomial

$X = \#$  of working CD players

$n = 15$

$p = p(\text{working}) = 0.8$

$$P(2 \leq X < 6) = P(2 \leq X \leq 5)$$

$$\begin{array}{c} \text{X} \quad \text{P} \quad \text{q} \\ \hline 0 \quad 1 \quad 2 \quad 5 \quad 15 \\ \hline \end{array}$$

$$\text{binomcdf}(15, 0.8, 5) - \text{binomcdf}(15, 0.8, 1)$$

$$= \boxed{0.0001}$$

10. For any normal curve, which one of the following statements is TRUE? For any statement below which is not true, explain how to make the statement true.

I. The <sup>smaller</sup> larger the standard deviation, the "steeper" the curve.

II. The curve is symmetric about the line  $x = \mu$ .

III. 95.45% of the data lies within two standard deviations of the mean.

11. A group of employees was surveyed:  $M =$  male,  $F =$  female,  $E =$  engineer,  $A =$  accountant. For the following, write the correct mathematical notation for the probability you are finding using the variables above, as you will not be able to determine the numerical answers.

(a) What's the probability that a randomly selected employee is a female engineer?  $P(F \cap E)$

(b) What's the probability that a randomly selected male is an accountant?  $P(A|M)$

(c) What's the probability that a randomly selected engineer is male?  $P(M|E)$

(d) If a randomly selected employee is male, what's the probability that he is an engineer?  $P(E|M)$

(e) What's the probability that a randomly selected employee is a female or is not an accountant?

$$P(F \cup A^c)$$

12. Classify the following random variables as finite discrete, infinite discrete, or continuous AND find the values that the random variable may obtain.

- (a)  $X$  = the number of draws needed, without replacement from a standard 52-card deck, until a heart is drawn

Classification: Finite Discrete Values of  $X$  = 1, 2, 3, ..., 40

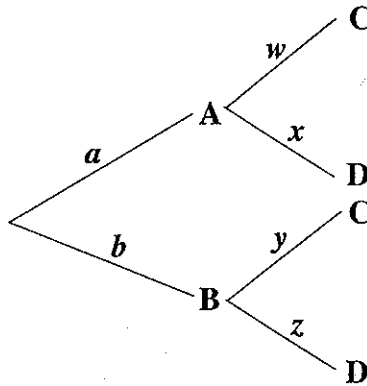
- (b)  $X$  = the number of hours you study for your math test during the 48 hours prior to your test

Classification: Continuous Values of  $X$  =  $0 \leq X \leq 48$

- (c)  $X$  = the number of times you roll a fair six-sided die until you roll a "3"

Classification: Infinite Discrete Values of  $X$  = 1, 2, 3, ...

13.



Using the variables on the branches of the tree diagram above, show how you would compute the value of the following probabilities. You will not have numerical answers. For example,  $P(B) = b$ .

$$(a) P(C|B) = y \quad \left[ \text{or } \frac{P(C \cap B)}{P(B)} = \frac{b \cdot y}{b} = y \right]$$

$$(b) P(C) = aw + by$$

$$(c) P(A|D) = \frac{P(A \cap D)}{P(D)} = \frac{ax}{ax + bz}$$

$$(d) P(A \cup C) = P(A) + P(C) - P(A \cap C) \\ = a + [aw + by] - aw = a + by$$

14. Alison has 8 quarters, 3 dimes, and a nickel in the bottom of her purse. If she randomly chooses 4 coins from the bottom of her purse, what is the probability that she will choose exactly 2 quarters or exactly 2 dimes?

$$P\left(\begin{array}{c} 2Q \\ 2NQ \end{array}\right) + P\left(\begin{array}{c} 2D \\ 2ND \end{array}\right) - P\left(\begin{array}{c} 2Q \\ 2D \end{array}\right)$$

$$\frac{C(8,2)C(4,2) + C(3,2)C(9,2) - C(8,2)C(3,2)}{C(12,4)}$$

$$= \frac{192}{495} = \frac{64}{165}$$

15. Given the following test grades for one class, find the statistics which follow. Round answers to 4 decimal places, if necessary.

$$L_1 \rightarrow 66, 57.5, 61.5, 78.5, 69.5, 88, 84.5, 88.5, 65, 89, 75, 85.5, 93, 89, 89, 63$$

1-varStats  $L_1$

(a) Mean =  $\bar{x} = 77.65625$

(b) Median =  $Med = 81.5$

(c) Standard Deviation =  $\sigma_x = 11.7443$

(d) Variance =  $(\sigma_x)^2 = 137.9287$

(e) Mode =  $89$

16. The mean weight of a box of cereal is 16 ounces with a standard deviation of 0.72 ounces. If the weights of cereal boxes are normally distributed, what is the probability (rounded to four decimal places) that a box of cereal weighs between 15 and 18 ounces?

$X = \text{weights (in oz.)}$

$$P(15 < X < 18) = \text{normalcdf}(15, 18, 16, 0.72)$$

$$= 0.9148$$

