AP STAT TEST REVIEW CHAPTERS 7 & 8 Name Mine

For each multiple choice question, choose the best answer. For free response questions, round to the specified place value.

1. Family size can be represented by the random variable X. Determine the average family size.

X	2	3	4	5
P(X)	.17	.47	.26	.10

$E(x) = 2(.17) + 3(.47) + 4(.26) + 5(.1)$

(a) 2.94 (b) 3.00 (c) 3.29 (d) 3.49 (e) 3.86

2. The heights of married men are approximately normally distributed with a mean of 70 and a standard deviation of 3, while the heights of married women are approximately normal distributed with a mean of 65 and a standard deviation of 2.5. Determine the probability that a randomly selected married woman is taller than a randomly selected married men.

(a) 0.05
(b) 0.10
(c) 0.15
(d) 0.20
(e) Cannot be determined from the given information.

$\mu_M = 70$ $\mu_F = 65$ $\mu_{F-M} = 65 - 70 = -5$ $\sigma_{F-M} = \sqrt{15.25} = 3.905$

$\sigma_M = 3$ $\sigma_F = 2.5$ $\sigma^2_{F-M} = (2.5)^2 + (3)^2 = 15.25$ $P((F-M) > 0) = P\left(z > \frac{0-(-5)}{3.91}\right)$

$P(z > 1.28) = .10$

3. Suppose the average height of policemen is 71 inches with a standard deviation of 4 inches, while the average for policewoman is 66 inches with a standard deviation of 3 inches. If a committee looks at all ways of pairing up one male with one female officer, what will be the mean and standard deviation for the difference in heights for the set of possible partners?

(a) Mean of 5 inches with a standard deviation of 1 inch.
(b) Mean of 5 inches with a standard deviation of 3.5 inches.
(c) Mean of 5 inches with a standard deviation of 5 inches.
(d) Mean of 68.5 inches with a standard deviation of 1 inch.
(e) Mean of 68.5 inches with a standard deviation of 3.5 inches.

$\mu_{x-y} = \mu_x - \mu_y = 71 - 66 = 5$

$\sigma_{x-y} = \sqrt{\sigma_x^2 + \sigma_y^2} = \sqrt{(4)^2 + (3)^2} = \sqrt{25} = 5$

4.. Which of the following are true statements?

T I. By the law of large numbers, the mean of a random variable will get closer and closer to a specific value.
T II. The standard deviation of a random variable is never negative.
T III. The standard deviation of a random variable is 0 only if the random variable takes a lone single value.

(a) I and II (b) I and III (c) II and III (d) II and III (e) I, II, and III

Use the following information for questions 5-7. The independent random variables X and Y are defined by the following probability distribution tables.

X	1	3	6
P(X)	.6	.3	.1

Y	2	3	5	7
P(Y)	.1	.2	.3	.4

$\mu_X = 1(.6) + 3(.3) + 6(.1) = 2.1$ $\mu_Y = 2(.1) + 3(.2) + 5(.3) + 7(.4) = 5.1$

$\sigma_X = 1.578$ $\sigma_Y = 1.814$

5. Determine the mean of X+Y

(a) 7.2 (b) 8.4 (c) 5.1 (d) 9 (e) 4.3

$\mu_{X+Y} = \mu_X + \mu_Y = 2.1 + 5.1 = 7.2$

6. Determine the standard deviation of 3Y + 5

(a) .44 (b) 3.62 (c) 0 (d) 5.1 (e) 5.44

$\sigma_{3Y+5} = \sqrt{(3)^2(1.814)^2} = 5.44$

7. Determine the standard deviation of 4X - 5Y.

(a) 15.38 (b) -2.76 (c) 11.05 (d) 10.62 (e) cannot be determined from information given

$\sigma_{4X-5Y} = \sqrt{(4)^2(1.578)^2 + (5)^2(1.814)^2} = 11.05$

8. The amount of pollutants a factory dumps into a river is approximately normally distributed with a mean of 2.43 and a standard deviation of 0.88 tons. What is the probability ~~that it~~ dumps more than 3 tons? $\mu = 2.43$ $\sigma = .88$

(a) 0.2578 (b) 0.2843 (c) 0.6500 (d) 0.7157 (e) 0.7422

$P(X>3) = P\left(Z > \frac{3-2.43}{.88}\right)$
$= P(Z > .6477) = .2586$ closest to

9. Which of the following is **not** true concerning discrete probability distribution?

(a) The probability of any specific value is between 0 and 1, inclusive. T
(b) The mean of the distribution is between the smallest and largest value in the distribution. T
(c) The sum of all probabilities is 1. T
(d) The standard deviation of the distribution is between –1 and 1. F $\sigma > 0$
(e) The distribution may be displayed using a probability histogram. T

10. In a population of students, the number of calculators owned is a random variable X with P(X = 0) = 0.2, P(X = 1) = 0.6, and P(X = 2) = 0.2. The mean of this probability distribution is $\mu = (.2)(0) + (.6)(1) + (.2)(2) = 1$

(a) 0 (b) 2 (c) 1 (d) 0.5 (e) The answer cannot be computed from the information given.

11. Refer to the previous problem. The variance of this probability distribution is $\sigma^2 = (0-1)^2(.2) + (1-1)^2(.6) + (2-1)^2(.2) = .4$

(a) 1 (b) 0.63 (c) 0.5 (d) 0.4 (e) The answer cannot be computed from the information given.

12. A random variable Y has the following distribution:

Y	-1	0	1	2
P(Y)	3C	2C	0.4	0.1

$3C + 2C + .4 + .1 = 1$
$5C = .5$
$C = .1$

The value of the constant C is:
(a) 0.10 (b) 0.15 (c) 0.20 (d) 0.25 (e) 0.75

Use this information for #13 & 14. On a recent AP Stat test in Mrs. Dillon's class, the mean was 61 with a standard deviation of 11.36. In yet another act of benevolence, Mrs. Dillon decides to scale the scores so her students will not be denied admission to the college of their choice. She decides the actual grades will become: **Grade = 1.5 * Score – 20.**

$\mu = 61$ $\sigma = 11.36$
$Y = a + bX$ $a = -20$ $b = 1.5$ grade = 1.5(score) – 20

13. Determine the mean of the transposed scores. **(tenths)**

$\mu_{grade} = -20 + 1.5(61) = \boxed{71.5}$

14. Determine the standard deviation of the transposed scores. **(hundredths)**

$\sigma_{grade} = \sqrt{(1.5)^2(11.36)^2} = \boxed{17.04}$

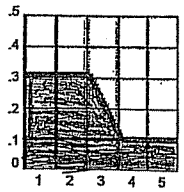
15. A box contains 5 pennies, 5 dimes, 1 quarter, and 1 half dollar. You reach into the box (without looking) and select a single coin. What is the probability that the selected coin will be worth between 5 cents and 35 cents? **(whole percent)**

X	.01	.10	.25	.50
P(X)	5/12	5/12	1/12	1/12

$P(.05 \le X \le .35) = 5/12 + 1/12 = 6/12 = \boxed{50\%}$

X = value of coin selected, n = 12

Here is the probability density function for a continuous random variable. Determine the following probabilities. **(tenths)**



16. $P(0 \le X \le 3) = .8$
17. $P(2 < X < 3) = .5$
18. $P(X = 2) = 0.0$
19. $P(1 \le X < 5) = 1.0$

Use this information for #20 – 23. ACT scores for the 1,171,460 members of the 2004 high school graduating class who took the test closely followed the distribution N(20.9,4.8). Choose 2 students independently and at random from this group.

$\mu = 20.9$ $\sigma = 4.8$

20. What is the expected sum of their scores?

$\mu_{x+y} = \mu_x + \mu_y = 20.9 + 20.9 = \boxed{41.8}$

21. What is the expected difference of their scores?

$\mu_{x-y} = 20.9 - 20.9 = \boxed{0}$

22. What is the standard deviation of the difference of their scores? $\sigma_{X-Y} = \sqrt{\sigma_X^2 + \sigma_Y^2} = \sqrt{(4.8)^2 + (4.8)^2} = \sqrt{46.08} = 6.78$

23. Find the probability that the **sum** of their scores is greater than 50.

$P(X > 50) = P\left(z > \frac{50 - 41.8}{6.78}\right) = P(z > 1.21) = 11.3\%$

A box contains ten \$1 bills, five \$2 bills, three \$5 bills, one \$10 bill, and one \$100 bill. A person is charged \$20 to select one bill.

24. In the long run, what is the average amount a person will select from the box? X = value of currency selected

X	1	2	5	10	100
P(X)	.5	.25	.15	.05	.05

$E(X) = \$7.25$ In the long run, expected payout is \$7.25.

In a lottery, 10,000 tickets are sold at \$1 each with a prize of \$7500 for **one** winner. Therefore the actual winnings are \$7499. (Not fair game!)

X = amt won in lottery

Outcome	Win	Lose
X	?7499	-1
P(X)	? 1/10000	?9999/10000

25. In the long run, what is the average result, μ, for each bettor?

$E(X) = -.25$ Bettor loses \$.25 on average

Use this information to answer #26 - 29. A manager must choose among three options. Option A has a 10% chance of resulting in a \$250,000 gain but otherwise will result in a \$10,000 loss. Option B has 50% chance of gaining \$40,000 and a 50% chance of losing \$2,000. Option C has a 5% chance of gaining \$800,000 but otherwise will result in a loss of \$20,000.

26. Define a random variable X for this problem.

27. Complete the following table:

	Opt A		Opt B		Opt C	
Outcome:	G	L	G	L	G	L
X	250,000	-10,000	40,000	-2,000	800,000	-20,000
P(X)	.1	.9	.5	.5	.05	.95

28. What is the average return for each option? $E(A) = 16,000$ $E(B) = \$19,000$ $E(C) = \$21,000$

29. Discuss which option the manager should choose.

Option C has highest average return, however there is a higher risk of loss.

30. A highway engineer knows that his crew can lay 5 miles of highway on a clear day, 2 miles on a rainy day, and only one mile on a snowy day. Suppose the probabilities are as follows:

Outcome	Clear	Rain	Snow
X	5	2	1
P(X)	0.6	? .3	0.1

Calculate the expected value and the variance. $\mu_X = 3.7$ $\sigma_X^2 = 2.61$

31. A dealer in the Sands Casino in Las Vegas selects 40 cards from a standard deck of 52 cards. Let Y be the number of red cards (hearts or diamonds) in the 40 cards selected. Which of the following best describes this setting?

(a) Y has a binomial distribution with $n = 40$ observations and probability of success $p = 0.5$.
(b) Y has a binomial distribution with $n = 40$ observations and probability of success $p = 0.5$, provided the deck is shuffled well.
(c) Y has a binomial distribution with $n = 40$ observations and probability of success $p = 0.5$, provided after selecting a card it is replaced in the deck and the deck is shuffled well before the next card is selected.
(d) Y has a normal distribution with mean $p = 0.5$.

32. Assume the probability that a baseball player will get a hit in any at-bat is 0.250. Which expression will yield the probability that his first hit will occur on his 5th at-bat?

Wait-time

(a) $\binom{5}{4}(.250)^4(.750)^1$ (b) $(.750)^4(.250)^1$ (c) $(.250)^4(.750)^1$ (d) $\binom{5}{1}(.250)^1(.750)^4$

(e) None of these is correct

Use the distributions at the right to answer #33 – 35.

I		II		III		IV	
X	p	X	p	X	p	X	p
0	.5	10	.2	−2	0	1	−.1
1	.2	12	.2	−5	0	2	.2
2	.2	15	.3	−10	.3	3	.3
3	.1	19	.2	−14	.3	4	.3
4	.1	25	.1	−20	.4	5	.3

33. Which table does not constitute a legitimate discrete probability distribution?

(a) I only (b) I and IV (c) I, II, and IV (d) III only (e) I and III

34. Which probability distribution has the greatest mean?

(a) I (b) II (c) III (d) IV (e) There is no maximum

35. Which probability distribution has the smallest standard deviation?

(a) I (b) II (c) III (d) IV (e) There is no minimum

36. Binomial and geometric probability situations share all of the following conditions except one. Identify the choice that is not shared.

TRUE

(a) The probability of success on each trial is the same.
(b) There are only two outcomes
(c) The focus of the problem is the number of successes in a given number of trials.
(d) The probability of a success equals 1 minus the probability of a failure.
(e) All of these are shared by binomial and geometric situations.

37. The reason we impose the criteria of $np \geq 10$ and $n(1-p) \geq 10$ is so that

(a) both p and $1-p$ will be equally represented. (b) application of the binomial probability model is appropriate.
(c) skewness is eliminated from the solution of the problem.
(d) the binomial distribution is not severely skewed so that a normal approximation is appropriate.
(e) None of these contains the reason.

38. A knife thrower estimates that he can hit his target 95% of the time. Assuming that each of his throws is independent, which of the following statements is correct?

(a) P(4 hits in his next 6 throws) = $\binom{6}{4}(.05)^2(.95)^4$ (b) P(4 hits in his next 6 throws) = $(.05)^4(.95)^2$

(c) P(4 hits in his next 6 throws) = $\binom{6}{4}(.05)^4(.95)^2$ (d) P(4 hits in his next 6 throws) = $(.05)^2(.95)^4$

(e) None of these is correct.

39. The school library has determined that the probability of any book being returned prior to or on its due date is independent of the probability of other books and is approximately 60%. If we were to calculate the probability that more than 70 out of the next 100 books are returned prior to or on their due dates, which of the following expressions would be **incorrect** to use for this calculation?

(a) I only (b) II only (c) III only (d) I and III (e) II and III

I. $\binom{100}{70}(.6)^{70}(.4)^{30} + \binom{100}{71}(.6)^{71}(.4)^{29} + \cdots + \binom{100}{100}(.6)^{100}(.4)^0$

II. $\binom{100}{71}(.6)^{71}(.4)^{29} + \binom{100}{72}(.6)^{72}(.4)^{28} + \cdots + \binom{100}{100}(.6)^{100}(.4)^0$

III. $P(X > 70.5)$ using $Normal(60, 4.8990)$