AP Statistics

Review Week 4

Probability

Advanced Placement AAP Review will be held in **room 315** and **312** on Tuesdays and Thursdays.

The week of April 13th we will be reviewing **PROBABILITY.**

The session will begin in room 315 with a brief review of the weekly topic.

Instruction will be from 3:15 pm to 3:30 pm

Once we have reviewed the topic you may begin practicing the questions in your review packet.

Answers will be posted in room 315 and 312 all week and will be posted on line after 3:00 pm on Friday the week of review.

If you have difficulty with a question look at the detailed answer postings BEFORE you ask your teacher for help.

Get a hint….**DON'T COPY THE ANSWER!!! THAT IS NOT HELPFUL!!**

When you have completed a question…**REFLECT!!!!** Ask yourself what skill you used to solve that problem and write that down!!

Once we have completed the weekly review, keep it to study from as we get closer to the exam.

Probability

Brief Review

Probability is likely the hardest unit that we do.

The best advice that I can give is to rely less on what you THINK is the logical way to do the problem and rely more on formulas and the processes we used in the course.

AND logical operator should lead to multiplication. INTERSECTION

OR logical operator should lead to addition. UNION

A given B is A and B divided by B

Visuals:

- Venn Diagrams
- Tree Diagrams
- Contingency Table

Independent Events: don't change the outcome of each other.

- To prove independence show the probability of A is the same as the probability of A given B.

Mutually Exclusive Events: Can NOT happen at the same time.

- To prove ME show that the intersection is zero.

FORMULAS:

$$P(A \cup B) = P(A) + P(B) - P(A \cap B)$$

$$P(A|B) = \frac{P(A \cap B)}{P(B)}$$

$$E(X) = \mu_x = \sum x_i p_i$$

$$\mathrm{Var}(X) = \sigma_x^2 = \sum \left(x_i - \mu_x\right)^2 p_i$$

$$P(X = k) = \binom{n}{k} p^k (1-p)^{n-k}$$

$$\mu_x = np$$

$$\sigma_x = \sqrt{np(1-p)}$$

$$\mu_{\hat{p}} = p$$

$$\sigma_{\hat{p}} = \sqrt{\frac{p(1-p)}{n}}$$

2007 EXAM

6. A fair coin is to be flipped 5 times. The first 4 flips land "heads" up. What is the probability of "heads" on the next (5th) flip of this coin?

(A) 1
(B) $\frac{1}{2}$
(C) $\binom{5}{1}\left(\frac{1}{2}\right)^4\left(\frac{1}{2}\right)$
(D) $\left(\frac{1}{2}\right)^4\left(\frac{1}{2}\right)$
(E) 0

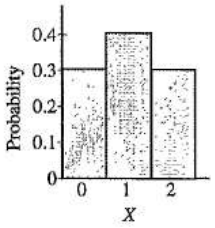
16. Lynn is planning to fly from New York to Los Angeles and will take the Airtight Airlines flight that leaves at 8 A.M. The Web site she used to make her reservation states that the probability that the flight will arrive in Los Angeles on time is 0.70. Of the following, which is the most reasonable explanation for how that probability could have been estimated?

(A) By using an extended weather forecast for the date of her flight, which showed a 30% chance of bad weather
(B) By making assumptions about how airplanes work, and factoring all of those assumptions into an equation to arrive at the probability
(C) From the fact that, of all airline flights arriving in California, 70% arrive on time
(D) From the fact that, of all airline flights in the United States, 70% arrive on time
(E) From the fact that, on all previous days this particular flight had been scheduled, it had arrived on time 70% of those days

36. An experiment has three mutually exclusive outcomes, A, B, and C. If P(A) = 0.12, P(B) = 0.61, and P(C) = 0.27, which of the following must be true?

I. A and C are independent.
II. P(A and B) = 0
III. P(B or C) = P(B) + P(C)

(A) I only
(B) I and II only
(C) I and III only
(D) II and III only
(E) I, II, and III



38. A game of chance is played in which X, the number of points scored in each game, has the distribution shown above. Which of the following is true for the sampling distribution of the sum, Y, of the scores when the game is played twice?

(A) Y takes on values 0, 1, 2 with respective probabilities 0.3, 0.4, and 0.3.
(B) Y takes on values 0, 2, 4 according to a binomial distribution with mean equal to 2.
(C) Y takes on values 0, 2, 4 with respective probabilities 0.3, 0.4, and 0.3.
(D) Y takes on values 0, 1, 2, 3, 4 according to a binomial distribution with mean equal to 2.
(E) Y takes on values 0, 1, 2, 3, 4 with respective probabilities 0.09, 0.24, 0.34, 0.24, and 0.09.

2002 Exam

5. The number of sweatshirts a vendor sells daily has the following probability distribution.

Number of Sweatshirts x	0	1	2	3	4	5
$P(x)$	0.3	0.2	0.3	0.1	0.08	0.02

If each sweatshirt sells for \$25, what is the expected daily total dollar amount taken in by the vendor from the sale of sweatshirts?

(A) \$5.00
(B) \$7.60
(C) \$35.50
(D) \$38.00
(E) \$75.00

23. Which of the following statements is true for two events, each with probability greater than 0 ?

(A) If the events are mutually exclusive, they must be independent.
(B) If the events are independent, they must be mutually exclusive.
(C) If the events are not mutually exclusive, they must be independent.
(D) If the events are not independent, they must be mutually exclusive.
(E) If the events are mutually exclusive, they cannot be independent.

32. In a carnival game, a person can win a prize by guessing which one of 5 identical boxes contains the prize. After each guess, if the prize has been won, a new prize is randomly placed in one of the 5 boxes. If the prize has not been won, then the prize is again randomly placed in one of the 5 boxes. If a person makes 4 guesses, what is the probability that the person wins a prize exactly 2 times?

(A) $\frac{2!}{5!}$

(B) $\frac{(0.2)^2}{(0.8)^2}$

(C) $2(0.2)(0.8)$

(D) $(0.2)^2(0.8)^2$

(E) $\binom{4}{2}(0.2)^2(0.8)^2$

36. An urn contains exactly three balls numbered 1, 2, and 3, respectively. Random samples of two balls are drawn from the urn with replacement. The average, $\overline{X} = \frac{X_1 + X_2}{2}$, where X_1 and X_2 are the numbers on the selected balls, is recorded after each drawing. Which of the following describes the sampling distribution of $\overline{X}$?

(A)

$\overline{X}$	1	1.5	2	2.5	3
Probability	$\frac{1}{5}$	$\frac{1}{5}$	$\frac{1}{5}$	$\frac{1}{5}$	$\frac{1}{5}$

(B)

$\overline{X}$	1	1.5	2	2.5	3
Probability	$\frac{1}{9}$	$\frac{2}{9}$	$\frac{1}{3}$	$\frac{2}{9}$	$\frac{1}{9}$

(C)

$\overline{X}$	1	1.5	2	2.5	3
Probability	0	0	1	0	0

(D)

$\overline{X}$	1	1.5	2	2.5	3
Probability	$\frac{1}{10}$	$\frac{1}{10}$	$\frac{3}{5}$	$\frac{1}{10}$	$\frac{1}{10}$

(E) It cannot be determined from the information given.

1997 Exam

3. A magazine has 1,620,000 subscribers, of whom 640,000 are women and 980,000 are men. Thirty percent of the women read the advertisements in the magazine and 50 percent of the men read the advertisements in the magazine. A random sample of 100 subscribers is selected. What is the expected number of subscribers in the sample who read the advertisements?

   (A) 30
   (B) 40
   (C) 42
   (D) 50
   (E) 80

4. A manufacturer makes lightbulbs and claims that their reliability is 98 percent. Reliability is defined to be the proportion of nondefective items that are produced over the long term. If the company's claim is correct, what is the expected number of nondefective lightbulbs in a random sample of 1,000 bulbs?

   (A) 20
   (B) 200
   (C) 960
   (D) 980
   (E) 1,000

11. The XYZ Office Supplies Company sells calculators in bulk at wholesale prices, as well as individually at retail prices. Next year's sales depend on market conditions, but executives use probability to find estimates of sales for the coming year. The following tables are estimates for next year's sales.

WHOLESALE SALES

Number Sold	2,000	5,000	10,000	20,000
Probability	0.1	0.3	0.4	0.2

RETAIL SALES

Number Sold	600	1,000	1,500
Probability	0.4	0.5	0.1

What profit does XYZ Office Supplies Company expect to make for the next year if the profit from each calculator sold is \$20 at wholesale and \$30 at retail?

(A) \$10,590
(B) \$220,700
(C) \$264,750
(D) \$833,100
(E) \$1,002,500

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13. Joe and Matthew plan to visit a bookstore. Based on their previous visits to this bookstore, the probability distributions of the number of books they will buy are given below.

Number of books Joe will buy	0	1	2
Probability	0.50	0.25	0.25

Number of books Matthew will buy	0	1	2
Probability	0.25	0.50	0.25

Assuming that Joe and Matthew make their decisions independently, what is the probability that they will purchase no books on this visit to the bookstore?

(A) 0.0625
(B) 0.1250
(C) 0.1875
(D) 0.2500
(E) 0.7500

20. If a customer rolls the dice and rents a second movie every Thursday for 30 consecutive weeks, what is the approximate probability that the total amount paid for these second movies will exceed \$15.00 ?

(A) 0
(B) 0.09
(C) 0.14
(D) 0.86
(E) 0.91

26. A fair coin is flipped 10 times and the number of heads is counted. This procedure of 10 coin flips is repeated 100 times and the results are placed in a frequency table. Which of the frequency tables below is most likely to contain the results from these 100 trials?

(A)

Number of Heads	Frequency
0	19
1	12
2	9
3	6
4	2
5	1
6	3
7	5
8	8
9	14
10	21

(B)

Number of Heads	Frequency
0	9
1	9
2	9
3	9
4	9
5	10
6	9
7	9
8	9
9	9
10	9

(C)

Number of Heads	Frequency
0	0
1	0
2	6
3	9
4	22
5	24
6	18
7	12
8	7
9	2
10	0

(D)

Number of Heads	Frequency
0	7
1	10
2	6
3	11
4	8
5	10
6	9
7	12
8	7
9	11
10	9

(E)

Number of Heads	Frequency
0	0
1	0
2	0
3	2
4	24
5	51
6	22
7	1
8	0
9	0
10	0

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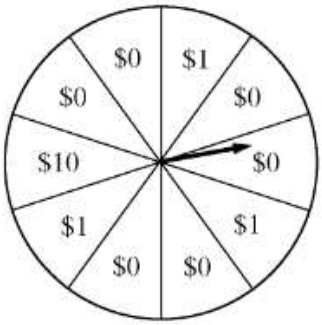
2012 #2

2. A charity fundraiser has a Spin the Pointer game that uses a spinner like the one illustrated in the figure below.



A donation of $2 is required to play the game. For each $2 donation, a player spins the pointer once and receives the amount of money indicated in the sector where the pointer lands on the wheel. The spinner has an equal probability of landing in each of the 10 sectors.

(a) Let X represent the net contribution to the charity when one person plays the game once. Complete the table for the probability distribution of X.

x	$2	$1	−$8
$P(x)$			

(b) What is the expected value of the net contribution to the charity for one play of the game?

(c) The charity would like to receive a net contribution of $500 from this game. What is the fewest number of times the game must be played for the expected value of the net contribution to be at least $500 ?

(d) Based on last year's event, the charity anticipates that the Spin the Pointer game will be played 1,000 times. The charity would like to know the probability of obtaining a net contribution of at least $500 in 1,000 plays of the game. The mean and standard deviation of the net contribution to the charity in 1,000 plays of the game are $700 and $92.79, respectively. Use the normal distribution to approximate the probability that the charity would obtain a net contribution of at least $500 in 1,000 plays of the game.

2011 #2

2. The table below shows the political party registration by gender of all 500 registered voters in Franklin Township.

PARTY REGISTRATION–FRANKLIN TOWNSHIP

	Party W	Party X	Party Y	Total
Female	60	120	120	300
Male	28	124	48	200
Total	88	244	168	500

(a) Given that a randomly selected registered voter is a male, what is the probability that he is registered for Party Y?

(b) Among the registered voters of Franklin Township, are the events "is a male" and "is registered for Party Y" independent? Justify your answer based on probabilities calculated from the table above.

2010 #4

4. An automobile company wants to learn about customer satisfaction among the owners of five specific car models. Large sales volumes have been recorded for three of the models, but the other two models were recently introduced so their sales volumes are smaller. The number of new cars sold in the last six months for each of the models is shown in the table below.

Car Model	A	B	C	D	E	Total
Number of new cars sold in the last six months	112,338	96,174	83,241	3,278	2,323	297,354

The company can obtain a list of all individuals who purchased new cars in the last six months for each of the five models shown in the table. The company wants to sample 2,000 of these owners.

(a) For simple random samples of 2,000 new car owners, what is the expected number of owners of model E and the standard deviation of the number of owners of model E?

(b) When selecting a simple random sample of 2,000 new car owners, how likely is it that fewer than 12 owners of model E would be included in the sample? Justify your answer.

(c) The company is concerned that a simple random sample of 2,000 owners would include fewer than 12 owners of model D or fewer than 12 owners of model E. Briefly describe a sampling method for randomly selecting 2,000 owners that will ensure at least 12 owners will be selected for each of the 5 car models.

2008 #3

3. A local arcade is hosting a tournament in which contestants play an arcade game with possible scores ranging from 0 to 20. The arcade has set up multiple game tables so that all contestants can play the game at the same time; thus contestant scores are independent. Each contestant's score will be recorded as he or she finishes, and the contestant with the highest score is the winner.

After practicing the game many times, Josephine, one of the contestants, has established the probability distribution of her scores, shown in the table below.

Josephine's Distribution				
Score	16	17	18	19
Probability	0.10	0.30	0.40	0.20

Crystal, another contestant, has also practiced many times. The probability distribution for her scores is shown in the table below.

Crystal's Distribution			
Score	17	18	19
Probability	0.45	0.40	0.15

(a) Calculate the expected score for each player.

(b) Suppose that Josephine scores 16 and Crystal scores 17. The difference (Josephine minus Crystal) of their scores is -1. List all combinations of possible scores for Josephine and Crystal that will produce a difference (Josephine minus Crystal) of -1, and calculate the probability for each combination.

(c) Find the probability that the difference (Josephine minus Crystal) in their scores is -1.

(d) The table below lists all the possible differences in the scores between Josephine and Crystal and some associated probabilities.

Distribution (Josephine minus Crystal)						
Difference	-3	-2	-1	0	1	2
Probability	0.015			0.325	0.260	0.090

Complete the table and calculate the probability that Crystal's score will be higher than Josephine's score.