Time Frame: 50 minutes

Subject Matter: Probabilities for “At Least”

TELL ME

Anticipatory Set:

The medal distribution from the 2000 Summer Olympic Games is shown in the table.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | *Gold* | *Silver* | *Bronze* | *Total* |
| United States | 39 | 25 | 33 |  |
| Russia | 32 | 28 | 28 |  |
| China | 28 | 16 | 15 |  |
| Australia | 16 | 25 | 17 |  |
| Others | 186 | 205 | 235 |  |
| Total |  |  |  |  |

Choose one medal winner at random.

1. Find the probability that the winner won the gold medal, given that the winner was from the United States.
2. Find the probability that the winner was from the United States, given that he or she won the gold medal.
3. Find the probability that the winner won the silver medal, given that the winner was from Australia.

Objective: TSWBAT find probabilities for “At Least”.

Standards: DA – 1.1, 1.2, & 1.5

Materials: PowerPoint Presentation and Worksheets

SHOW ME

Presentation of Information:

Example 1:

 A game is played by drawing four cards from an ordinary deck and replacing each card after it is drawn. Find the probability of winning if at least on ace is drawn.

 Solution:

* It is much easier to find the probability that has no aces are drawn (i.e. losing) and then
* Subtract from 1, than to find the solution directly, because
* That involve finding the probability of getting one ace, two aces, three aces, and four aces and then adding the results.

Let

 E = at least one ace is drawn $\overbar{E}$ = no aces drawn

 $P\left(\overbar{E}\right)= \frac{48}{52}×\frac{48}{52}×\frac{48}{52}×\frac{48}{52}$

 $P\left(\overbar{E}\right)= \frac{12}{13}×\frac{12}{13}×\frac{12}{13}×\frac{12}{13} = \frac{20,736}{28,561}$

Hence,

 $P\left(E\right)= 1-P(\overbar{E})$

 $P\left(winning\right)= 1-P(lossing)$

 $P\left(E\right)= 1- \frac{20,736}{28,561} $

 $P\left(E\right)= 1- 0.726$

 $P\left(E\right)= 0.274 Answer$

Example 2:

 A coin is tossed five times. Find the probability of getting at least one tail.

 Solution:

* It is easier to find the probability of the complement of the event, which is “all heads”, and then
* Subtract from 1, than to get the probability of at least one tail.

Let

 E = at least one tail is drawn $\overbar{E}$ = “all heads” are drawn

 $P\left(\overbar{E}\right)= \frac{1}{2}×\frac{1}{2}×\frac{1}{2}×\frac{1}{2}×\frac{1}{2}$

 $P\left(\overbar{E}\right)= \frac{1}{32}$

Hence,

 $P\left(E\right)= 1-P(\overbar{E})$

 $P\left(at least one tail\right)= 1-P(all heads)$

 $P\left(E\right)= 1- \frac{1}{32} $

 $P\left(E\right)= 1-\left(\frac{1}{32}\right) \leftarrow plug this in your calculator$

 $P\left(E\right)= \frac{31}{32} Answer$

Example 3:

 A Neckware Association of America reported that 3% of ties sold in the United States are bow ties. If 4 customers who purchased a tie are randomly selected, find the probability that at least one purchased a bow tie.

 Solution:

* It is easier to find the probability of the complement of the event, which is “no bow tie” is purchased, and then
* Subtract from 1, than to get the probability of at least one purchased a bow tie.

Let

 E = at least one bow tie is purchased $\overbar{E}$ = “no bow tie” is purchased

 E = 3% $\overbar{E}$ = 97%

 $P\left(\overbar{E}\right)=\left(0.97\right)×\left(0.97\right)×\left(0.97\right)×(0.97)$

 $P\left(\overbar{E}\right)= 0.885$

Hence,

 $P\left(E\right)= 1-P(\overbar{E})$

 $P\left(at least one bow tie\right)= 1-P(no bow tie)$

 $P\left(E\right)= 1- 0.885 $

 $P\left(E\right)= 0.115 Answer$

Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Period: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date: \_\_\_\_\_\_\_\_\_\_\_\_\_\_

LET ME TRY

1. According to the *Statistical Abstract of the United States,* 70.3% of females ages 20 to 24 have never been married. Choose five young women in this age category at random. Find the probability that
2. None have ever been married.
3. At least one has been married.
4. The American Automobile Association (AAA) reports that of the fatal car/truck accidents, 54% are caused by car driver error. If 3 accidents are chosen at random, find the probability that
5. All are caused by car driver error.
6. None are caused by car driver error.
7. At least one is caused by car driver error.

Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Period: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date: \_\_\_\_\_\_\_\_\_\_\_\_\_\_

HOMEWORK

1. Seventy-six percent of toddlers get their recommended immunizations. Suppose that 6 toddlers are selected at random. What is the probability that at least one has not received the recommended immunization?
2. A lot of portable radios contain 15 good radios and 3 defective ones. If two are selected and tested, find the probability that at least 1 will be defective.
3. Fifty-eight percent of American children (ages 3 to 5) are read every day by someone at home. Suppose 5 children are randomly selected. What is the probability that at least 1 is read to ever day by someone at home?

Probability for “at least”

Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Period: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date: \_\_\_\_\_\_\_\_\_\_\_\_\_

Solve the following. Make sure to show your work.

1. Of Ph. D. students, 60% have paid assistantships. If 3 students are selected at random, find the probabilities that
	1. All have assistantships.
	2. None have assistantships.
	3. At least 1 has an assistantship.
2. If 4 cards are drawn from a deck and not replaced, find the probability of getting at least 1 club.
3. At a local clinic there are 8 men, 5 women, and 3 children in the waiting room. If three patients are randomly selected, find the probability that there is at least 1 child among them.
4. It has been found that 6% of all automobiles on the road have defective brakes. If 5 automobiles are stopped and checked by the state police, find the probability that at least 1 will have defective brakes.
5. A medication is 75% effective against a bacterial infection. Find the probability that if 12 people take the medication, at least one person’s infection will not improve.
6. A coin is tossed 6 times. Find the probability of getting at least one tail.
7. From the digits 0 through 9 if three digits are randomly selected, find the probability of getting at least one 7. Digits can be used more than once.

Quiz

Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Period: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date: \_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. According to the *Statistical Abstract of the United States,* 70.3% of females ages 20 to 24 have never been married. Choose four young women in this age category at random. Find the probability that
2. All four have been married.
3. At least one has not been married.
4. The American Automobile Association (AAA) reports that of the fatal car/truck accidents, 54% are caused by car driver error. If 5 accidents are chosen at random, find the probability that
5. None are caused by car driver error.
6. All are caused by car driver error.
7. At least one is caused by car driver error.
8. Seventy-six percent of toddlers get their recommended immunizations. Suppose that 6 toddlers are selected at random. What is the probability that at least one has not received the recommended immunization?
9. Fifty-eight percent of American children (ages 3 to 5) are read every day by someone at home. Suppose 5 children are randomly selected. What is the probability that at least 1 is read to ever day by someone at home?
10. Of Ph. D. students, 65% have paid assistantships. If 4 students are selected at random, find the probabilities that
11. All have assistantships.
12. None have assistantships.
13. At least 1 has an assistantship.
14. If 4 cards are drawn from a deck and replacing each card after it is drawn, find the probability of getting at least 1 diamond.
15. At a local clinic there are 10 men, 6 women, and 4 children in the waiting room. If four patients are randomly selected, find the probability that there is at least 1 child among them.
16. It has been found that 6% of all automobiles on the road have defective brakes. If 4 automobiles are stopped and checked by the state police, find the probability that at least 1 will have defective brakes.
17. A medication is 75% effective against a bacterial infection. Find the probability that if 10 people take the medication, at least one person’s infection will not improve.
18. A coin is tossed 6 times. Find the probability of getting at least one tail.
19. From the digits 0 through 9 if three digits are randomly selected, find the probability of getting at least one 7. Digits can be used more than once.