

Instructions:

1. Part 2 is based on the Movie “ Nova: Prediction by the numbers” that was assigned last week. Link <https://www.dailymotion.com/video/x6fi9b3>
2. **Please show all your work of each question, out the explanation at the end of each one.** You may use a calculator or Excel for computations.

1) The National Center for Health Statistics reported that of every 883 deaths in recent years, 44 resulted from an automobile accident, 162 from cancer, and 333 from heart disease. What is the probability that a particular death is due to an automobile accident?

A) 44/883 or 0.0498

B) 539/883 or 0.610

C) 24/333 or 0.072

D) 162/883 or 0.183

Explanation:-

probability that a particular death is due to an automobile accident= (death from an automobile)/total no of deaths=44/883 or 0.0498

2) If two events A and B are mutually exclusive, what does the special rule of addition state?

A) $P(A \text{ or } B) = P(A) + P(B)$

B) $P(A \text{ and } B) = P(A) + P(B)$

C) $P(A \text{ and/or } B) = P(A) + P(B)$

D) $P(A \text{ or } B) = P(A) - P(B)$

Explanation:-

Addition Rule 1: When two events, A and B, are mutually exclusive, the probability that A or B will occur is that the sum of the probability of every event

3) What does the complement rule state?

A) $P(A) = P(A) - P(B)$

B) $P(A) = 1 - P(\text{not } A)$

C) $P(A) = P(A) \times P(B)$

D) $P(A) = P(A) \times P(B)$

In complement rule,

For two events to be complements, they need to be mutually exclusive and exhaustive, meaning that one or the opposite must occur. Therefore, the probabilities of an event and its complement must always total to 1.

$P(A) + P(\text{not } A) = 1$

4) Which approach to probability is exemplified by the following formula?

Probability of an event = $\frac{\text{Number of times event occurred in the past}}{\text{Total number of observations}}$

A) The classical approach

B) The empirical approach

C) The subjective approach

D) None of these answers are correct.

Explanation:-

Since, in the empirical approach is for relative or experimental probability of an event is the ratio of the number of outcomes in which a specified event occurs to the total number of trials,

So, **Probability of an event** =(Number of time event occurred in the past)/(total number of observations)

5) A study of 200 computer service firms revealed these incomes after taxes:

Income After Taxes	Number of Firms
Under \$1 million	102
\$1 million up to \$20 million	61
\$20 million or more	37

What is the probability that a particular firm selected has under \$1 million income after taxes?

A) 0.00

B) 0.25

C) 0.49

D) 0.51

Explanation:-

probability that a particular firm selected has under \$1 million income after taxes=(probability that a particular firm selected has under \$1 million income after taxes)

i.e;

102/200=0.51

6) A firm offers routine physical examinations as part of a health service program for its employees. The exams showed that 8% of the employees needed corrective shoes, 15% needed major dental work, and 3% needed both corrective shoes and major dental work. What is the probability that an employee selected at random will need either corrective shoes or major dental work?

A) 0.20

B) 0.25

C) 0.50

D) 1.00

Explanation:-

Let A be the event of employees needed corrective shoes and B be the event that they needed major dental work .

We are given that : $P(A) = 0.08$; $P(B) = 0.15$; $P(A \cap B) = 0.03$

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

Then, $P(A \cup B) = 0.08 + 0.15 - 0.03 = 0.20$

Hence, the probability that an employee selected randomly will need either corrective shoes or major dental work : $P(A \cup B) = 0.20$

hence, the correct option is (A).

7) A survey of top executives revealed that 35% of them regularly read *Time* magazine, 20% read *Newsweek*, and 40% read *U.S. News & World Report*. A total of 10% read both *Time* and *U.S. News & World Report*. What is the probability that a particular top executive reads either *Time* or *U.S. News & World Report* regularly?

A) 0.85

B) 0.06

C) 1.00

D) 0.65

Explanation:

Let *Time* magazine be represented by T

Newsweek represented by N

the probability that a particular top executive reads either *Time* or *U.S. News & World Report* regularly

$$\begin{aligned} P(T \cup N) &= P(T) + P(N) - P(T \cap N) \\ &= 0.35 + 0.40 - 0.10 = 0.65 \end{aligned}$$

8) A study by the National Park Service revealed that 50% of the vacationers going to the Rocky Mountain region visit Yellowstone Park, 40% visit the Grand Tetons, and 35% visit both. What is the probability that a vacationer will visit at least one of these magnificent attractions?

A) 0.95

B) 0.35

C) 0.55

D) 0.05

Explanation:-

Let A be the event that a vacationer visits Yellowstone Park and B be the event that a vacationer visits the Tetons.

$$P(A) = 0.5$$

$$P(B) = 0.4$$

$$P(A \text{ and } B) = 0.35$$

$$P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B) = 0.5 + 0.4 - 0.35 = 0.55$$

9) A tire manufacturer advertises, "The median life of our new all-season radial tire is 50,000 miles. An immediate adjustment will be made on any tire that does not last 50,000 miles." You purchased four of these tires. What is the probability that all four tires will wear out before traveling 50,000 miles?

A) 1/10 or 0.10

B) 1/4 or 0.25

C) 1/64 or 0.0156

D) 1/16 or 0.0625

Explanation:

The median life of radial tire is 50,000 miles.

So, the probability that a tire wear out before traveling 50,000 miles is $1/2$

Since 4 tires are purchased, so the probability that all four tires wear out before traveling 50,000 miles is equal to $(1/2)^4 = 1/16 = 0.0625$

10) There are 10 AAA batteries in a box and 3 are defective. Two batteries are selected without replacement. What is the probability of selecting a defective battery followed by another defective battery?

A) $1/2$ or 0.50

B) $1/4$ or 0.25

C) $1/120$ or about 0.0083

D) $1/15$ or about 0.07

Explanation:-

$$P = \frac{({}^3C_2)({}^7C_1) + ({}^3C_3)({}^7C_1)}{{}^{10}C_2} = 1/15 = 0.07(\text{aprox})$$

Part2:

Question # 1 (50 Points): List and discuss (in about 50 words each) **FIVE** statistical concepts that you learnt in class and were also depicted in the movie. (Example Law of large numbers).

1. Sample

A sample is a small set of data that one chooses from a large population using a specific sampling method. These selection methods could either be random or systematic. An example from the movie is choosing people randomly from the crowd and asking them how money jerries are in the jar. The randomly selected person from the crowd is the sample.

2. Data

Data are individual pieces of factual information observed or recorded and thus will be used for research analysis. Data is the raw material of statistics. In a weight guessing contest, the answers collected are referred to as data and are further subjected to analysis for meaningful inference.

3. P- value

P-value is an extremely important concept in statistics is commonly used in hypothesis testing. The p-value is normally the evidence against the null hypothesis. Statistically, when the p-value is smaller, there is strong evidence to reject the null hypothesis. An example of the p-value was designed by Ronald. A Fisher on the experiment about the lady who predicted milk added to tea and tea into milk.

4. Hypothesis

In statistics, a hypothesis is an assumption or a claim about a certain parameter. Hypothesis testing is thus the process done using various statistical methods to accept or reject the hypothesis. The procedures for testing the hypothesis through statistical experiments and processes were first introduced by a German scientist Ronald. A Fisher.

5. Statistically Significant

In statistics, the results of an experiment are said to be statistically significant if it's not likely caused by chance. The p-value thus is critically important in determining if the results of an experiment were statically significant or not. Statistical significant is thus used to determine if the results of the statistic are liable. A good place to use Statistical significance is in checking out whether the opinion polls are true or not.