**Question One -**

A: Null Hypothesis: If a poker dealing machine deals cards at random then all cards will be dealt in the same amount because no one card is more susceptible to being picked than another.

**Calculate Expected Values**

(1 / 4) \* 100 = 25%

|  |  |
| --- | --- |
| Sample Name  | Expected Value  |
| Spades | 25% |
| Hearts | 25% |
| Diamonds | 25% |
| Clubs | 25% |

**Given Observed Values**

# observed / Total Number of Cards = OV

|  |  |  |
| --- | --- | --- |
| Sample Name  | Calculate OV | Observed Value  |
| Spades | (420 / 1600) \* 100 = OV | 26.25% |
| Hearts | (436 / 1600) \* 100 = OV | 27.25% |
| Diamonds | (442 / 1600) \* 100 = OV | 27.63% |
| Clubs | (302 / 1600) \* 100 = OV | 18.88% |

**Calculate Chi Square Values for Each Sample**



|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Sample  | O | E | (O-E)2 | (O-E)2 / E | X2 Value for Sample  |
| Spade  | 26.25 | 25 | 1.56 | 0.06 | 0.06 |
| Hearts  | 27.25 | 25 | 5.06 | 0.20 | 0.2 |
| Diamonds  | 27.625 | 25 | 6.89 | 0.28 | 0.28 |
| Clubs  | 18.875 | 25 | 37.52 | 1.50 | 1.5 |
| X2 Value  |   |   |   |   | **2.04** |

**Calculate Degrees of Freedom (DF)**

 # Of samples – 1 = DF

**4-1 = 3 degrees of freedom**

B: We would accept the null hypothesis because the chi-square value of 2.04 is less than the critical value at 95% or (0.05) confidence of 7.82. This means that the cards are dealt at random.

**Question Two -**

A: Null Hypothesis: If you observe the following three organisms: snakes, rabbits, and chipmunks in their natural habitat over an extended period of time then you will see no difference in the amount of each species because they are all interconnected within their ecosystem will utilize the same resources.

**Calculate Expected Values**

|  |  |
| --- | --- |
| Sample Name  | Expected Value  |
| Snakes  | 33.3% |
| Rabbits | 33.3% |
| Chipmunks  | 33.3% |

**Given Observed Values**

|  |  |
| --- | --- |
| Sample Name  | Observed Value  |
| Snakes  | 30.78% |
| Rabbits | 34.55% |
| Chipmunks  | 34.68% |

**Calculate Chi Square Values for Each Sample**



|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Sample  | O | E | (O-E)2 | (O-E)2 / E | X2 Value for Sample  |
| Snakes | 30.78 | 33 | 4.93 | 0.15 | 0.15 |
| Rabbits | 34.55 | 33 | 2.40 | 0.07 | 0.07 |
| Chipmunks  | 34.68 | 33 | 2.82 | 0.09 | 0.09 |
| X2 Value  |   |   |   |   | **0.31** |

**Calculate Degrees of Freedom (DF)**

 # Of samples – 1 = DF

**3-1 = 2 degrees of freedom**

B: We would accept the null hypothesis because the chi-square value of 0.31 is less than the critical value at 95% or (0.05) confidence of 5.99. This means that the organisms would be seen at the same % throughout the day.

**Question Three -**

A: Null Hypothesis: If you cross an apple and orange then you will get a phenotypic distribution that results in 25% of the offspring being red, 19% of the offspring being orange, and 56% of the offspring being both red and orange because of independent assortment during meiosis.

**Calculate Expected Values**

|  |  |
| --- | --- |
| Sample Name  | Expected Value  |
| Red | 25% |
| Orange  | 19% |
| Both  | 56% |

**Given Observed Values**

|  |  |
| --- | --- |
| Sample Name  | Observed Value  |
| Red  | 28.4 % |
| Orange  | 23.3 % |
| Both  | 48.3 % |

**Calculate Chi Square Values for Each Sample**



|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Sample  | O | E | (O-E)2 | (O-E)2 / E | X2 Value for Sample  |
| Red | 28.4 | 25 | 11.56 | 0.46 | 0.46 |
| Orange | 23.3 | 19 | 18.49 | 0.97 | 0.97 |
| Both  | 48.3 | 56 | 59.29 | 1.06 | 1.06 |
| X2 Value  |   |   |   |   | **2.49** |

**Calculate Degrees of Freedom (DF)**

 # Of samples – 1 = DF

**3-1 = 2 degrees of freedom**

B: We would accept the null hypothesis because the chi-square value of 2.49 is less than the critical value at 95% or (0.05) confidence of 5.99. This means that statistically there the distribution of the phenotypic traits is due to random chance and not mutations or genetic abnormalities.