**Q1. Given two fair dices, what is the probability of getting scores that sum to**

**4? to 8?**

Total outcomes = 36

Sample space for sum = 4

{(1,3), (2,2), (3,1)}

P(sum=4) = 3/36=1/12

Sample space for sum = 8

{(2,6), (3,5), (4,4), (5,3), (6,2)}

P(sum=8) = 5/36

**Q2. Suppose that diastolic blood pressures (DBPs) for men aged 35–44 are**

**normally distributed with a mean of 80 (mm Hg) and a standard deviation of**

**10. What is the probability that a random 35–44-year-old has a DBP less than**

**70?**

Transforming data using z-score

z= (x-mu)/sigma

Here,

x= 70

mu= 80

sigma = 10

z= (70-80)/10

z= -1

Probability of z=-1 for standard distribution = 0.1587

Therefore, the probability that a random 35-44-year-old has a DBP less than 70 is approximately 0.1587 or 15.87%.

**Q3. In a population of interest, a sample of 9 men yielded a sample average**

**brain volume of 1,100cc and a standard deviation of 30cc. What is a 95%**

**Student’s T confidence interval for the mean brain volume in this new**

**population?**

CI = X̄ ± t\* (s/√n)

X̄ = 1100

s = 30

n = 9

α = 0.05

degrees of freedom = 9-1 = 8

t = 2.306

CI = 1100 ± 2.306\*(30/√9) = 1100 ± 23.077

Therefore, the 95% confidence interval for the population mean brain volume is (1076.92, 1123.08).

We can say the mean brain volume in this new population falls in this interval with 95% confidence.

**Q4. The average breaking strength of steel rods is specified to be 18.5**

**thousand pounds with standard deviation of 1.955. A sample of 14 rods were**

**tested, the mean strength was 17.85 thousand pounds. Is this result**

**significant?**

H0: Population mean breaking strength is 18.5 thousand pounds.

H1: Population mean breaking strength is less than 18.5 thousand pounds.

x\_bar = 17.85

mu = 18.5

s= 1.955

n= 14

alpha = 0.05

df = n-1 =13

t\_stat = (x\_bar - mu) / (s / sqrt(n)) = -1.24

t\_crit =  = -1.77

Since calculated t\_stat (-1.24) is more than critical t\_crit (-1.77) we reject the null hypothesis.

**Q5. A factory produces bolts with an average diameter of 21 mm. A random**

**sample of 25 bolts has a mean diameter of 22.6 mm and standard deviation 3**

**mm. Can we assume the sample has been drawn from the population at 5%**

**level of significance.**

H0: Sample has been drawn from the population, i.e. mu = 21

H1: Sample mean is greater than the population mean, i.e. mu>21

x\_bar = 22.6

mu = 21

s= 3

n= 25

alpha = 0.95 (0.05 significance)

df = n-1 = 24

t\_stat = (x\_bar - mu) / (s / sqrt(n)) = (22.6 - 21) / (3 / √25) = 2.66

t\_crit = t.ppf(alpha,df) = t(0.95,24) = 1.71

Since, t\_stat (2.66) is greater than t\_crit (1.77), we reject the null hypothesis. We thus conclude that the sample mean diameter is greater than the population mean diameter and hasn’t been drawn from the population at 5% level of significance.

**Q6. The blood groups of 200 people are distributed as follows: 50 have type A**

**blood, 65 have type B blood, 70 have type O blood type and 15 have AB type**

**blood. If a person from this group is selected at random, what is the probability**

**that this person has O blood type?**

Total= 200

O = 70

P(O) = 70/200 = 0.35

Therefore, the probability of selecting a person with O blood type is 0.35 or 35%.

**Q7. A box contains 90 discs numbered 1 to 90. One disc is drawn at random**

**from the box. What is the probability that it bears**

**a. a two-digit number**

**b. a perfect square**

**c. a multiple of 5**

**d. a number divisible by 3 and 5.**

1. Total number of two-digit numbers = 90-9 = 81

P(Two digit number) = 81/90 = 0.9 or 90%

1. Total number of perfect squares = 9

P(perfect square) = 9/90 = 0.1 or 10%

1. Total number of multiples of 5 = 18

P(multiple of 5 ) = 18/90 = 0.2 or 20%

1. Total number of numbers divisible by 3 and 5 = 6

P(numbers divisible by 3 and 5) = 6/90 = 0.067 or 6.7%

**Q8. A newly developed muesli contains five types of seeds (A, B, C, D and E).**

**The percentage of which is 35%, 25%, 20%, 10% and 10% according to the**

**product information. In a randomly selected seed, the following volume**

**distribution was found.**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **A** | **B** | **C** | **D** | **E** |
| **184** | **145** | **100** | **63** | **63** |

**Let us decide about the null hypothesis whether the composition of the sample**

**corresponds to the distribution indicated on the package at alpha= 0.1**

**significance level.**

|  |  |  |
| --- | --- | --- |
| **Seeds** | **Observed Frequency** | **Expected Frequency** |
| A | 184 | 555 \* 0.35 = 194.25 |
| B | 145 | 555 \* 0.25 = 138.75 |
| C | 100 | 555 \* 0.2 = 111 |
| D | 63 | 555 \* 0.1 = 55.5 |
| E | 63 | 555 \* 0.1 = 55.5 |

chi\_sq = ∑(observed frequency - expected frequency)² / expected frequency

chi\_sq = [(184 - 194.25)² / 194.25] + [(145 - 138.75)² / 138.75] + [(100 - 111)² / 111] + [(63 - 55.5)² / 55.5] + [(63 - 55.5)² / 55.5] = **3.93**

df = n-1 = 4

For critical region,

chi\_sq\_crit = chi2.ppf(0.90,4) = **7.779**

As chi-squared value calculated 3.93 is less than the critical value 7.779, we fail to reject the null hypothesis that the sample corresponds to the distribution indicated on the package at alpha= 0.1 significance level.

**Q9. Can a dice be considered regular which is showing the following frequency**

**distribution during 1000 throws?**

**1 – 182**

**2- 154**

**3- 162**

**4-175**

**5-151**

**6-176**

Total = 1000

|  |  |  |
| --- | --- | --- |
| **Seeds** | **Observed Frequency** | **Expected Frequency** |
| 1 | 182 | 1000 \* 1/6 = 166.67 |
| 2 | 154 | 1000 \* 1/6 = 166.67 |
| 3 | 162 | 1000 \* 1/6 = 166.67 |
| 4 | 175 | 1000 \* 1/6 = 166.67 |
| 5 | 151 | 1000 \* 1/6 = 166.67 |
| 6 | 176 | 1000 \* 1/6 = 166.67 |

chi\_sq = [(182-166.67)^2 / 166.67] + [(154-166.67)^2 / 166.67] + [(162-166.67)^2 / 166.67] + [(175-166.67)^2 / 166.67] + [(151-166.67)^2 / 166.67] + [(176-166.67)^2 / 166.67]

chi\_sq = **4.916**

For 5% significance, critical value for chi\_sq is

chi\_sq\_crit = chi2.ppf(0.95,5) = **11.07**

P(chi\_sq 4.916 ) = p = chi2.cdf(4.916,5) = 0.57

Since, the p-value is more than the significance level of 0.05, we fail to reject the null hypothesis and conclude that the dice is regular.