**Practical No.4**

The five numbers shown here are the first digits taken from the first row of the RAND’s random number table which are:{1,3,5,7,0}. Suppose they represent the number of mobiles in five randomly selected rural household. Assume these number represents a small population from which we are generating the sample distribution. Perform the following tasks:

1. Calculate the mean and variance of the given population of mobiles.
2. Construct all possible samples from this population of size 2 using sampling with replacement (WR).
3. Calculate from each possible samples, sample mean () & sample variance ().
4. Calculate the variance of the sample means, Var ().
5. Test if sample mean is unbiased estimate of the population mean?
6. Verify the direct formula to calculate the variance of the sample means viz. Var () = gives the same value as calculated from (d) above.

**Working Expression:**

* 1. **Population Mean:** It is the sum of all the observations of entire population to the total number of observations. It is denoted by and given by:

* 1. **Population Variance:** It is defined by

1. In case of Simple Random Sampling with Replacement (SRSWR), ‘n’ samples can be selected out of ‘N’ populations by Nn ways.
   1. **Sample Mean:** It is the ratio of sum of observations of entire sample population data to the total number of observations.

3.2 **Sample Variance**: The variance is mathematically defined as the average of the squared differences from the mean.

4. **Variance of Sample Means:**  The deviation of estimated mean $\hat m$  from the true mean *m* for a sample of length *n*. This difference is the **variance of the sample mean** and is given by $(\Lambda m)^2=\sigma_{\hat m}^2$

**5. Test of Biasness:**

**6. Verification of direct formula for Variance of sample mean:**

**Calculation:**

Here,

N=5 & n=2

Data = {1, 5, 7, 3, 0}

1. Population mean( ) = = 3.20

Population variance( ) = = 6.64

1. All the possible samples from this population size 2 using sampling with replacement are:

(1,1) (1,5) (1,7) (1,3) (1,0) (5,1) (5,5) (5,7) (5,3) (5,0) (7,1) (7,5) (7,7) (7,3) (7,0)

(3,1) (3,5) (3,7) (3,3) (3,0) (0,1) (0,5) (0,7) (0,3) (0,0)

So, N=25, n=5

1. For the computation of Sample Mean, Sample Variance and the variance of sample mean():

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Sample** | | **Sample Mean** | **Sample Variance(σ2)** | **(X'-X'')** | **(X'- X'')2** |
| 0 | 1 | 0.5 | 0.5 | -2.7 | 7.29 |
| 0 | 5 | 2.5 | 12.5 | -0.7 | 0.49 |
| 0 | 7 | 3.5 | 24.5 | 0.3 | 0.09 |
| 0 | 3 | 1.5 | 4.5 | -1.7 | 2.89 |
| 0 | 0 | 0 | 0 | -3.2 | 10.24 |
| 1 | 1 | 1 | 0 | -2.2 | 4.84 |
| 1 | 5 | 3 | 8 | -0.2 | 0.04 |
| 1 | 7 | 4 | 18 | 0.8 | 0.64 |
| 1 | 3 | 2 | 2 | -1.2 | 1.44 |
| 1 | 0 | 0.5 | 0.5 | -2.7 | 7.29 |
| 5 | 1 | 3 | 8 | -0.2 | 0.04 |
| 5 | 5 | 5 | 0 | 1.8 | 3.24 |
| 5 | 7 | 6 | 2 | 2.8 | 7.84 |
| 5 | 3 | 4 | 2 | 0.8 | 0.64 |
| 5 | 0 | 2.5 | 12.5 | -0.7 | 0.49 |
| 7 | 1 | 4 | 18 | 0.8 | 0.64 |
| 7 | 5 | 6 | 2 | 2.8 | 7.84 |
| 7 | 7 | 7 | 0 | 3.8 | 14.44 |
| 7 | 3 | 5 | 8 | 1.8 | 3.24 |
| 7 | 0 | 3.5 | 24.5 | 0.3 | 0.09 |
| 3 | 1 | 2 | 2 | -1.2 | 1.44 |
| 3 | 5 | 4 | 2 | 0.8 | 0.64 |
| 3 | 7 | 5 | 8 | 1.8 | 3.24 |
| 3 | 3 | 3 | 0 | -0.2 | 0.04 |
| 3 | 0 | 1.5 | 4.5 | -1.7 | 2.89 |
|  |  | 80 | 164 |  | 82 |

1. Here, = =

Var(X'- X'')2 =

1. Since, X’ = X’’ = 3.2, sample mean is unbiased estimate of the population mean.
2. Here,

Var = 6.56

**RESULT:**

**CONCLUSION:**