1. State whether the following statements are true or false and also give the reason in support of your answer:

a) In a sequence of random numbers, generated through LCG \( x_i = (12x_{i-1} + 6) \mod 11 \) with \( x_0 = 06 \), the \( x_1, x_2 \) and \( x_3 \) will be 11, 17, 12.

b) The probability of selection of a sample of \( n \) from the population by SRSWOR is \( 1/N \).

c) While analysing the data of a 4 \( \times \) 4 Latin Square design the error d.f. is equal to 10.

d) In a Two way analysis of variance with 5 blocks & 5 treatments the degree of freedom for the total variation is 14.

e) Suppose a random number generated by Middle. Square Method is 15, then the next random number will be 22.

**Ans:**

(b). SRSWOR is a method of selection of \( n \) units out of the \( N \) units one by one such that at any stage of selection, anyone of the remaining units have same chance of being selected, i.e. \( 1/N \).

2. A sample of 100 employees is to be drawn from a population of colleges A and B. The population means and population mean squares of their monthly wages are given below:

<table>
<thead>
<tr>
<th>Village</th>
<th>( N_i )</th>
<th>( \bar{X}_i )</th>
<th>( S^2_i )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Collage A</td>
<td>400</td>
<td>60</td>
<td>20</td>
</tr>
<tr>
<td>Collage B</td>
<td>200</td>
<td>120</td>
<td>80</td>
</tr>
</tbody>
</table>

Draw the samples using Proportional and Neyman allocation techniques and compare. Obtain the sample mean and variances for the Proportional Allocation and SRSWOR for the given information. Then Find the percentage gain in precision of variances of sample mean under the proportional allocation over the that of SRSWOR.

**Ans:** If we regard the colleges A and B representing two different strata then the problem is to draw as stratified sample of 100 employees using technique of proportional allocation and Neyman’s allocation.

In proportional allocation we have:

\[
\bar{X}_i = \frac{n_i}{N_i} \times \bar{X}_i
\]

\[
n_i = \frac{100 \times N_i}{600}
\]

\[
n_1 = \frac{100 \times 400}{600} = 66.67
\]

\[
n_2 = \frac{100 \times 200}{600} = 33.34
\]

In Neyman’s allocation, we have:

\[
\bar{X}_i = \frac{n_i}{N_i} \times \bar{X}_i
\]

\[
n_i = \frac{NS_i}{\sum N_i S_i}
\]

\[
\sum N_i S_i = 400 \times 4.47 + 200 \times 8.94 = 3576
\]

\[
n_1 = \frac{100 \times 3576}{3576} = 50
\]

\[
n_2 = \frac{200 \times 8.94}{3576} = 50
\]

Therefore, the samples regarding the colleges A and B for both allocations are obtained as:

<table>
<thead>
<tr>
<th></th>
<th>Proportional</th>
<th>Neyman</th>
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