

# Random Number Sampling

## Random Samples

When drawing a sample in order to estimate population parameters, such as the mean and standard deviation, we require that every member of the population has an equal chance of being selected.

## Simple Random Sample

A sample of size  $n$  is called a simple random sample if every other possible sample of size  $n$  has an equal chance of being selected.

### Example

In lottery as ticket sampling you put the ticket into a container and withdraw the required sample or equivalent.

One technique of ensuring simple random sampling takes place is random number sampling.

## Random Number Sampling

Each element of the population is assigned a number. Tables of random numbers are used to select the sample. The table is constructed so that each digit is equally likely to appear. You ignore numbers that fall outside the specified range.

### Example

In a simulation of traffic arriving at a road junction, it is known that there are on average ten cars arriving at the junction along one road per minute. The cars arrive, however, at random. Divide the minute into sixty seconds and use the table of random numbers below to determine in which of these sixty seconds a car will arrive in the simulation.

93	89	09	57	07	14
93	40	81	06	85	85
16	01	19	69	11	78
26	52	89	13	86	00
53	32	90	43	79	01
07	35	73	60	55	82



77	89	52	48	33	72
01	62	76	42	71	92
12	30	97	86	96	43
60	37	34	69	41	69
95	45	90	32	78	52
05	42	41	08	34	67
09	29	69	55	39	90
22	00	62	97	03	18
62	31	82	15	73	90
58	78	45	08	90	33
95	15	67	49	54	81

Solution

The table gives a range of 100 random numbers from 00 to 99. We require only 60 such numbers, so any number in the range 60 to 99 will simply be ignored. Of these 60 the probability of a car arriving is  $\frac{1}{6}$ , or 10 out of 60. We will say a car will arrive if the value of the random number lies between 00 and 09; otherwise the random number will represent a second in which there was no car arriving.

The numbers in the table that we will not use are grayed out.

93	89	39	57	07	14
93	40	81	26	85	85
16	01	19	69	11	78
26	52	89	13	86	00
53	32	90	43	79	01
07	35	73	59	55	82
77	89	52	48	33	72
01	62	76	42	71	92
12	30	97	86	96	43
60	37	34	69	41	69
95	45	90	32	78	52
45	42	41	08	34	67
09	29	69	55	39	90
22	00	62	97	03	18
62	31	82	15	73	90
58	78	45	08	90	33
95	15	67	49	54	21



Second	Random No.	Arrives
1	39	No
2	57	No
3	07	Yes
4	14	No
5	40	No
6	26	No
7	16	No
8	01	Yes
9	19	No
10	11	No
11	26	No
12	52	No
13	13	No
14	00	Yes
15	53	No
16	32	No
17	43	No
18	01	Yes
19	07	Yes
20	35	No
21	59	No
22	55	No
23	52	No
24	48	No
25	33	No
26	01	Yes
27	42	No
28	12	No
29	30	No
30	43	No

Second	Random No.	Arrives
31	37	No
32	34	No
33	69	No
34	41	No
35	45	No
36	32	No
37	52	No
38	45	No
39	42	No
40	41	No
41	08	Yes
42	34	No
43	09	Yes
44	29	No
45	55	No
46	39	No
47	22	No
48	00	Yes
49	03	Yes
50	18	No
51	31	No
52	15	No
53	58	No
54	45	No
55	08	Yes
56	33	No
57	15	No
58	49	No
59	54	No
60	21	No

Cars are simulated to arrive at 3, 8, 14, 18, 19, 26, 41, 43, 48, 49 and 55 seconds.

The advantages of random number sampling are (a) that it is random and free from bias and (b) every number has equal chance of selection

The disadvantage is that it is not suitable for large samples

