|  |  |
| --- | --- |
| **Inter-arrival Time (Min.)** | **Frequency** |
| 2 | 10 |
| 3 | 20 |
| 4 | 40 |
| 5 | 20 |
| 6 | 10 |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **S.No.** | **R.No.** | **Inter- Arrival Time** | **Arrival Time** | **Service Starts** | **Service Ends** | **Waiting Time** | |
| **Server** | **Person** |
| 1 | 17 | 3 | 10.03 | 10.03 | 10.08 | 3 | - |
| 2 | 86 | 5 | 10.08 | 10.08 | 10.13 | - | - |
| 3 | 84 | 5 | 10.13 | 10.13 | 10.18 | - | - |
| 4 | 79 | 5 | 10.18 | 10.18 | 10.23 | - | - |
| 5 | 33 | 4 | 10.22 | 10.23 | 10.28 | - | 1 |
| 6 | 55 | 4 | 10.26 | 10.28 | 10.33 | - | 2 |
| 7 | 6 | 2 | 10.28 | 10.33 | 10.38 | - | 5 |
| 8 | 42 | 4 | 10.32 | 10.38 | 10.43 | - | 6 |
| 9 | 93 | 6 | 10.38 | 10.43 | 10.48 | - | 5 |
| 10 | 38 | 4 | 10.42 | 10.48 | 10.53 | - | 6 |
| 11 | 58 | 4 | 10.46 | 10.53 | 10.58 | - | 7 |
| 12 | 71 | 5 | 10.51 | 10.58 | 11.03 | - | 7 |
| **Total** |  |  |  |  |  |  | **39** |

The service time is 5 minutes and there is only one ticket counter. The Railway station in charge is interested in predicting the operating characteristics of this counter during a typical operating day from 10.00 a.m. to 11.00 a.m. Use simulation to determine the average waiting time before service and average time a person spends in the system.

**Solution.**

From the given distribution of arrivals, the random numbers can be assigned to the arrival times as shown in table 1.

Table 1

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Inter-arrival Time (Min.)** | **Frequency** | **Probability** | **Cumulative Probability** | **R.No.** |
| 2 | 10 | 0.10 | 0.10 | 0 - 09 |
| 3 | 20 | 0.20 | 0.30 | 10 - 29 |
| 4 | 40 | 0.40 | 0.70 | 30 - 69 |
| 5 | 20 | 0.20 | 0.90 | 70 - 89 |
| 6 | 10 | 0.10 | 1.00 | 90 - 99 |

The first random number generated is 17, which corresponds to the inter-arrival time of 3 minutes. This implies that the first person arrives 3 minutes after the service window opens, as shown in table 2. Since the first person arrives at 10.03 a.m., therefore, the server has to wait for 3 minutes. The server takes 5 minutes and thus, the first person leaves the system at 10.08 a.m. (10.03 + .05). Similarly, other values can be calculated.

Table 2

Average waiting time before service.  
= Total waiting time (person)/Total no. of arrivals  
= 39/12 = 3.25 minutes.

Average time a person spends in the system.  
= Service time + Average waiting time before service  
= 5 + 3.25 = 8.25 minutes.