Lab 9

Objectives

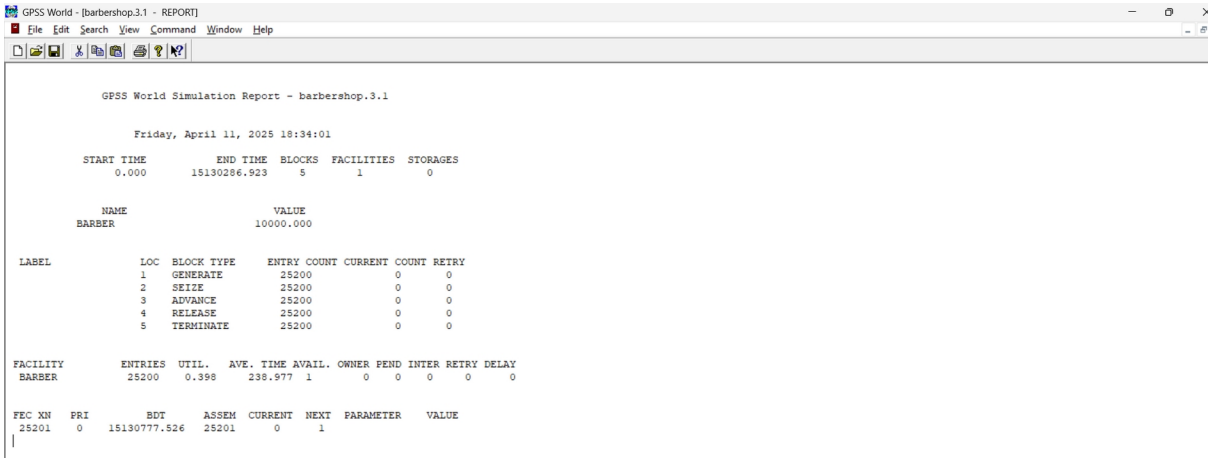
The objective of this lab is to understand and implement discrete event simulation using GPSS (General Purpose Simulation System) by modeling real-world systems such as service and inspection processes. Through the barber shop simulation, the goal is to analyze customer flow and service time over a defined period using arrival and service time distributions. The machine shop problems aim to simulate part production and inspection, incorporating randomness in processing and rejection, while demonstrating the use of both storage and facility constructs in GPSS. These exercises help in understanding queueing, resource allocation, and probabilistic decision-making in simulation.

Q.1. Write a GPSS program to simulate a barber shop for a day (10 am to 5 pm) where a customer enters the shop every 10±3 minutes and a barber takes 4±2 for a haircut.

Source code:

```
GENERATE 600,180

SEIZE BARBER

ADVANCE 240,120

RELEASE BARBER

TERMINATE 1

START 25200
```

Output:



```
GPSS World - [barbershop.3.1 - REPORT]
File Edit Search View Command Window Help

            GPSS World Simulation Report - barbershop.3.1

                Friday, April 11, 2025 18:34:01

         START TIME          END TIME  BLOCKS  FACILITIES  STORAGES
              0.000       15130286.923     5        1          0


            NAME                     VALUE
          BARBER                   10000.000


 LABEL             LOC  BLOCK TYPE     ENTRY COUNT CURRENT COUNT RETRY
                   1    GENERATE         25200             0       0
                   2    SEIZE            25200             0       0
                   3    ADVANCE          25200             0       0
                   4    RELEASE          25200             0       0
                   5    TERMINATE        25200             0       0


FACILITY         ENTRIES  UTIL.   AVE. TIME AVAIL. OWNER PEND INTER RETRY DELAY
 BARBER           25200    0.398     238.977  1        0    0    0     0      0


FEC XN   PRI          BDT      ASSEM  CURRENT  NEXT  PARAMETER    VALUE
 25201    0    15130777.526   25201      0      1
```

Q.2. A machine tool in a manufacturing shop is turning out parts at the rate of one every 5 minutes. As they are finished, the parts go to an inspector who takes 4±3 minutes to examine each one and rejects 10% of the parts. Write GPSS program for 1000 parts.

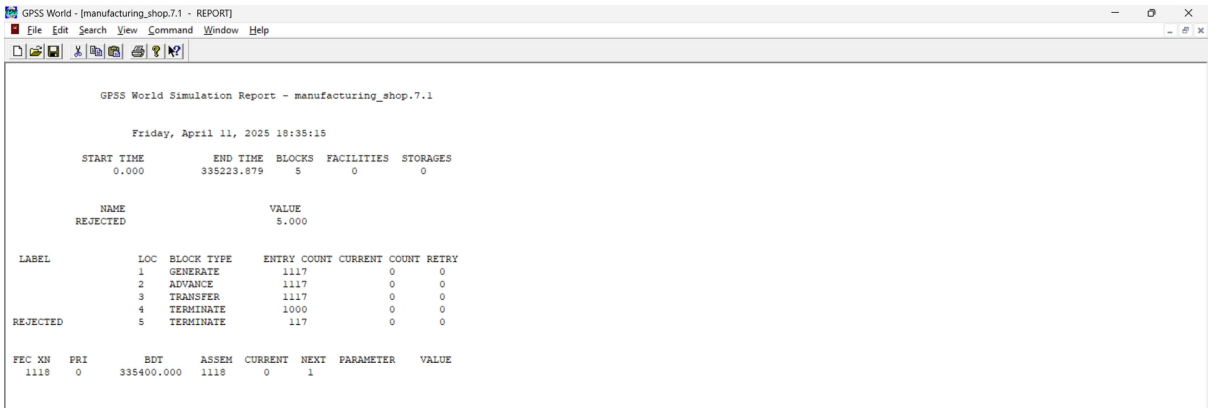
Source Code:

```
SIMULATE

GENERATE 300

ADVANCE 240,180

TRANSFER .1, REJECTED

TERMINATE 1
```

REJECTED TERMINATE 0

START 1000

Output:



```
GPSS World - [manufacturing_shop.7.1 - REPORT]
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            GPSS World Simulation Report - manufacturing_shop.7.1

                 Friday, April 11, 2025 18:35:15

          START TIME          END TIME  BLOCKS  FACILITIES  STORAGES
               0.000        335223.879     5        0          0

              NAME                      VALUE
          REJECTED                       5.000

 LABEL             LOC  BLOCK TYPE     ENTRY COUNT CURRENT COUNT RETRY
                   1    GENERATE          1117            0       0
                   2    ADVANCE           1117            0       0
                   3    TRANSFER          1117            0       0
                   4    TERMINATE         1000            0       0
REJECTED           5    TERMINATE          117            0       0

FEC XN   PRI         BDT      ASSEM  CURRENT  NEXT  PARAMETER    VALUE
  1118    0      335400.000   1118      0      1
```

Q.3. Implement Q. No. 2 using facility.

Source code:

GENERATE 5,,,1000

SEIZE INSPECTOR

ADVANCE 4,3

RELEASE INSPECTOR

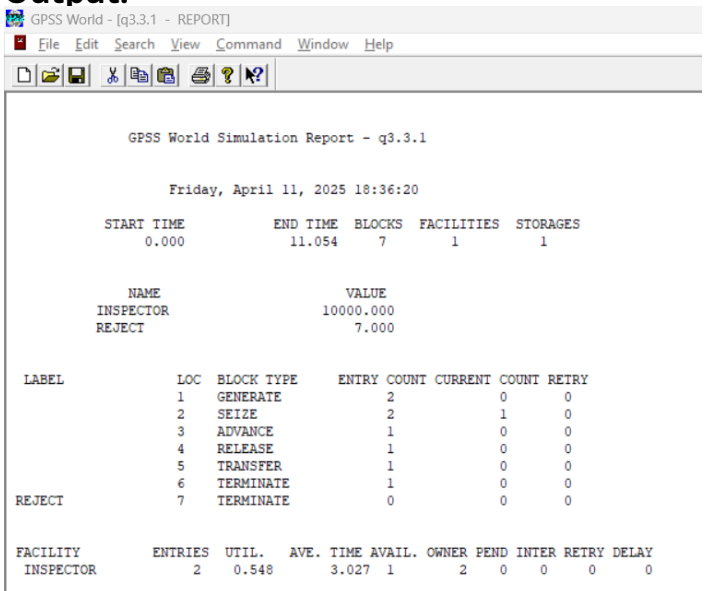
TRANSFER .1, REJECT

TERMINATE 1

REJECT TERMINATE 1

INSPECTOR STORAGE 1

Output:



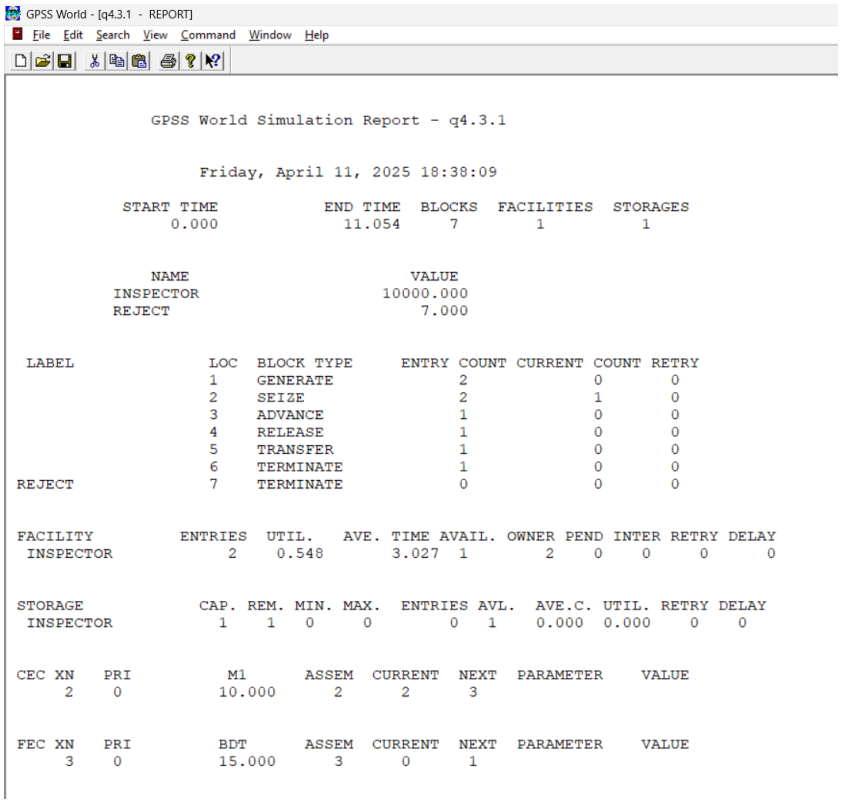
```
GPSS World - [q3.3.1 - REPORT]
File  Edit  Search  View  Command  Window  Help

            GPSS World Simulation Report - q3.3.1

                 Friday, April 11, 2025 18:36:20

          START TIME          END TIME  BLOCKS  FACILITIES  STORAGES
               0.000            11.054     7        1          1

              NAME                      VALUE
          INSPECTOR                  10000.000
          REJECT                         7.000

 LABEL             LOC  BLOCK TYPE     ENTRY COUNT CURRENT COUNT RETRY
                   1    GENERATE              2            0       0
                   2    SEIZE                 2            1       0
                   3    ADVANCE               1            0       0
                   4    RELEASE               1            0       0
                   5    TRANSFER              1            0       0
                   6    TERMINATE             1            0       0
REJECT             7    TERMINATE             0            0       0

FACILITY         ENTRIES  UTIL.   AVE. TIME AVAIL. OWNER PEND INTER RETRY DELAY
 INSPECTOR           2    0.548       3.027  1        2    0    0     0      0
```

Q.4. A machine tool in a manufacturing shop is turning out parts at the rate of every 5 minutes. When they are finished, the parts are sent to an inspector, who takes 4±3 minutes to examine each one and rejects 15% of the parts. Write a GPSS program to simulate using the concept of facility.

Source code:

```
GENERATE 5,,,1000

SEIZE INSPECTOR

ADVANCE 4,3

RELEASE INSPECTOR

TRANSFER .15, REJECT

TERMINATE 1

REJECT TERMINATE 1

INSPECTOR STORAGE 1
```

Output:



GPSS World Simulation Report - q4.3.1

Friday, April 11, 2025 18:38:09

START TIME	END TIME	BLOCKS	FACILITIES	STORAGES
0.000	11.054	7	1	1

NAME	VALUE
INSPECTOR	10000.000
REJECT	7.000

LABEL	LOC	BLOCK TYPE	ENTRY COUNT	CURRENT COUNT	RETRY
	1	GENERATE	2	0	0
	2	SEIZE	2	1	0
	3	ADVANCE	1	0	0
	4	RELEASE	1	0	0
	5	TRANSFER	1	0	0
	6	TERMINATE	1	0	0
REJECT	7	TERMINATE	0	0	0

FACILITY	ENTRIES	UTIL.	AVE. TIME	AVAIL.	OWNER	PEND	INTER	RETRY	DELAY
INSPECTOR	2	0.548	3.027	1	2	0	0	0	0

STORAGE	CAP.	REM.	MIN.	MAX.	ENTRIES	AVL.	AVE.C.	UTIL.	RETRY	DELAY
INSPECTOR	1	1	0	0	0	1	0.000	0.000	0	0

CEC XN	PRI	M1	ASSEM	CURRENT	NEXT	PARAMETER	VALUE
2	0	10.000	2	2	3		

FEC XN	PRI	BDT	ASSEM	CURRENT	NEXT	PARAMETER	VALUE
3	0	15.000	3	0	1		

Conclusion:

In conclusion, the GPSS simulations provided valuable insights into modeling real-world service and manufacturing systems through discrete event simulation. By simulating scenarios like barber shop operations and manufacturing inspections, we were able to observe the impact of arrival rates, service times, resource constraints, and rejection probabilities on system performance. The use of facilities and storage elements in GPSS allowed us to represent and manage limited resources effectively. Overall, these simulations enhanced our understanding of queueing behavior, system efficiency, and the importance of accurate modeling in decision-making and process optimization.