Control and Definitions

- SIMULATE: a control statement
  - specifying that a simulation run is to be run.
  - can be placed anywhere in the program.
  - if not present, the program is complied and not executed.
- Ampervariable: declare variables (preceded by &)
- Ampervariable can be either INTEGER or REAL
- Values of ampervariables can be defined by LET and BLET (block of LET) statements.

Block Statement - GENERATE

- Create transactions (customers) and send them into the system.
- Parameters: A,B,C,D,E

Parameters	Significance	Default
A	Average Interarrival time	0.0
B	±(half-interval)	0.0
C	offset interval first Xact	no offset
D	maximum number of Xact	no Limit
E	priority of Xact (integer)	0

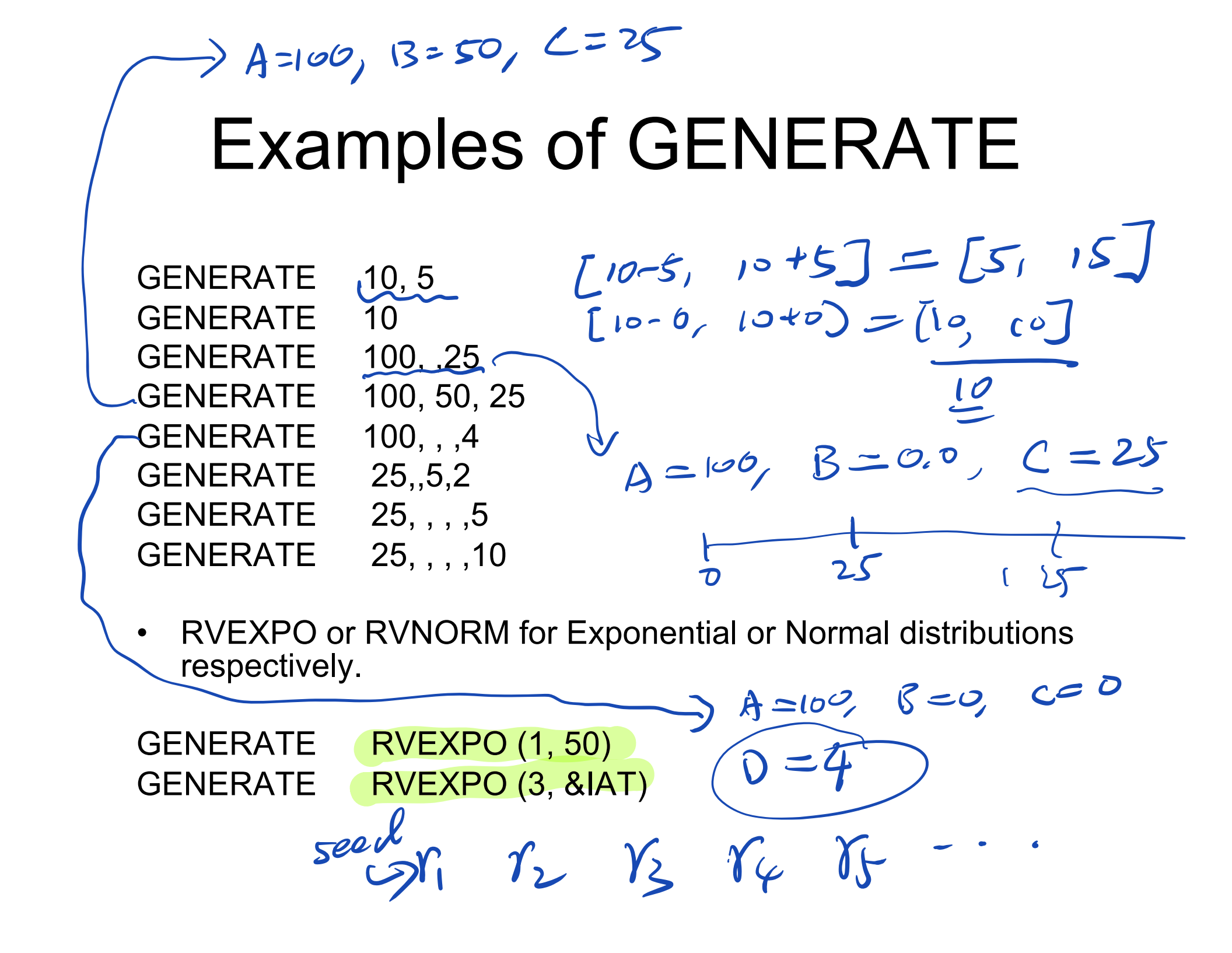
- Priority determines the order of time-tied Transactions move.

Examples of GENERATE

```
GENERATE    10, 5
GENERATE    10
GENERATE    100, ,25
GENERATE    100, 50, 25
GENERATE    100, , ,4
GENERATE     25,,5,2
GENERATE     25, , , ,5
GENERATE     25, , , ,10
```

- RVEXPO or RVNORM for Exponential or Normal distributions respectively.

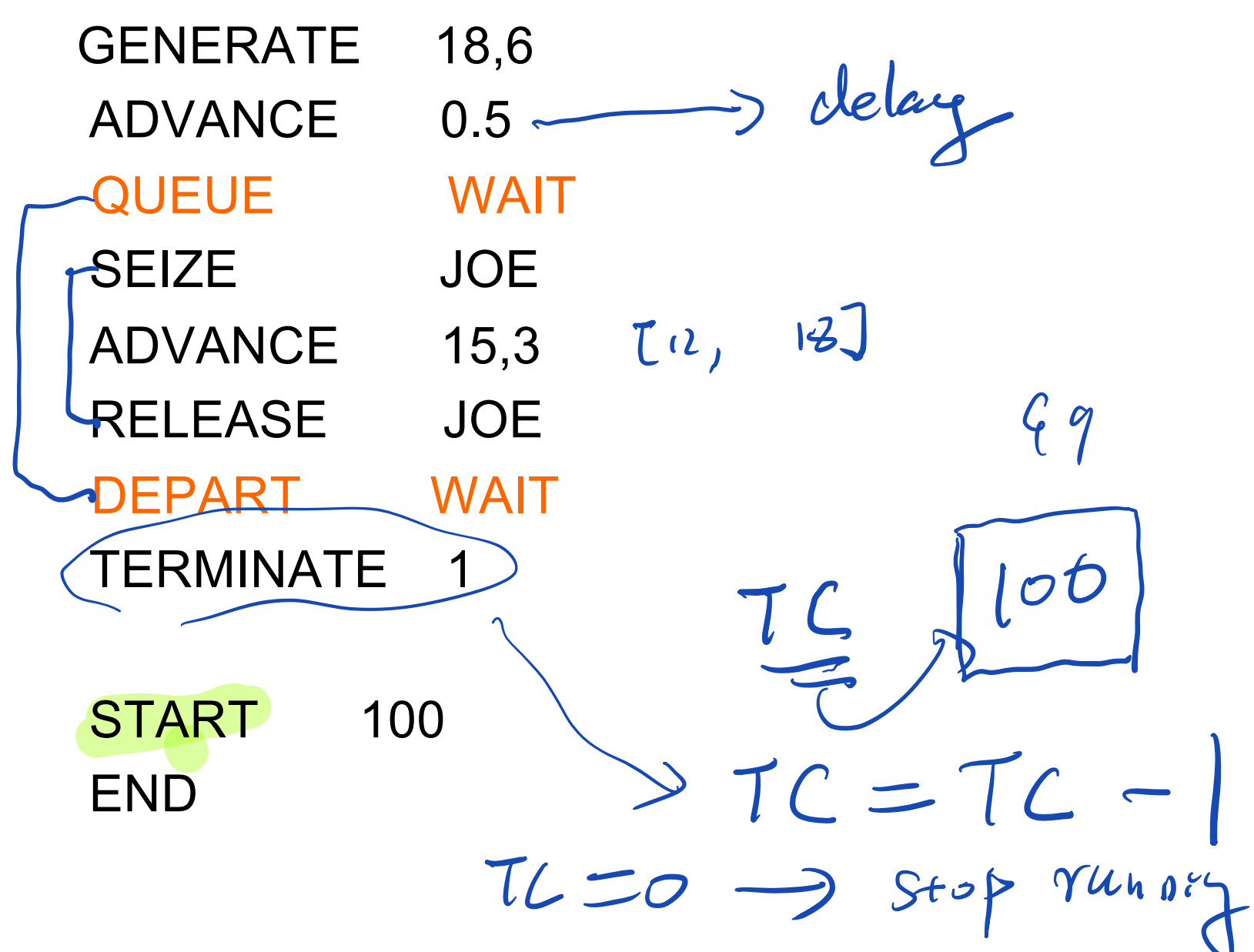
```
GENERATE    RVEXPO (1, 50)
GENERATE    RVEXPO (3, &IAT)
```



Example 2

```
GENERATE     18,6
 ADVANCE     0.5
 QUEUE       WAIT
 SEIZE       JOE
 ADVANCE     15,3
 RELEASE     JOE
 DEPART      WAIT
 TERMINATE   1

*
 START       100
 END
```



QUEUE and DEPART

- To gather statistics.
- QUEUE LINE

  the parameter LINE specifies an address of where to store the statistics.
- All transactions entering this block cause the appropriate data collection to occur.
- QUEUE/DEPART block has zero-delay on transactions.

SEIZE and RELEASE

- SEIZE: governs the admission of transactions to a facility.
- The name of the facility is given as a parameter (could be a number).
- SEIZE CHECKOUT

  Now leave the queue (LINE), recording the delay time in the queue statistics.
- A facility can be busy/idle.
- A transaction can only join a facility when it is idle.
- RELEASE: Free the facility for use by the next transaction.

ADVANCE- delay a transaction

- Model the service provided to transactions.
- ADVANCE A, B

  A: mean service time

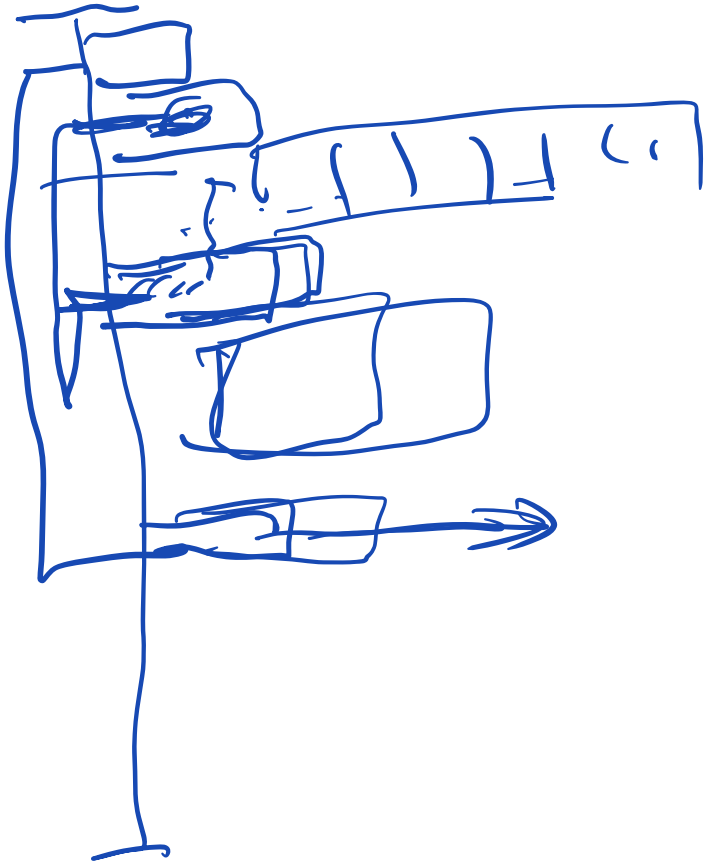
  B: ±(half interval)
- Example: ADVANCE 90, 20

[70, 110]

Delay for an average of 90 seconds with a variation of 20 seconds either way, representing time for the banking to be done. The delay is chosen randomly with uniform probability in the 70 to 110 second range. The facility remains in use for this period.

Example 3

```
GENERATE     18,6
 ADVANCE     0.5
 QUEUE       WAIT
 QUEUE       CHAIR
 SEIZE       JOE
 DEPART      CHAIR
 ADVANCE     15,3
 RELEASE     JOE
 DEPART      WAIT
  TERMINATE  1
*
  START      100
  END
```



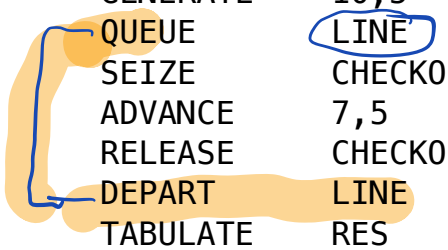
Example 4

```
* Define Ampervariables
                INTEGER     &LIMIT
                LET             &LIMIT=1000
* Block Statements
                GENERATE    10,5
                QUEUE           LINE
                SEIZE             CHECKOUT
                ADVANCE        7,5
                RELEASE        CHECKOUT
                DEPART          LINE
                TABULATE     RES
                TERMINATE   1
 RES          TABLE           M1,5,5,10
*
                START           &LIMIT
                END
```

```
    STUDENT GPSS/H RELEASE 2.01 (EP292)     04 Mar 2007   23:46:37
FILE: ex1.gps

    LINE# STMT#  IF DO  BLOCK#  *LOC    OPERATION   A,B,C,D,E,F,G
COMMENTS

         1     1                *1234567890123456789012345678901
         2     2                           SIMULATE
         3     3                *          Define Ampervariables
         4     4                           INTEGER     &LIMIT
         5     5                           LET         &LIMIT=1000
         6     6                *          Block Statements
         7     7           1               GENERATE    10,5
         8     8           2               QUEUE       LINE
         9     9           3               SEIZE       CHECKOUT
        10    10           4               ADVANCE     7,5
        11    11           5               RELEASE     CHECKOUT
        12    12           6               DEPART      LINE
        13    13           7               TABULATE    RES
        14    14           8               TERMINATE   1
        15    15                       RES TABLE       M1,5,5,10
        16    16                *
        17    17                           START       &LIMIT
        18    18                           END
```



```
24
25 ENTITY DICTIONARY (IN ASCENDING ORDER BY ENTITY NUMBER; "*" => VALUE
… CONFLICT.)
26
27       Facilities: 1=CHECKOUT
28
29           Queues: 1=LINE
30
31           Tables: 1=RES
32
33    Integer &Vars: 1=LIMIT
34
```

```
35
36 SYMBOL   VALUE   EQU DEFNS  CONTEXT      REFERENCES BY STATEMENT NUMBER
37
38 CHECKOUT     1              Facility         9    11
39
40 LINE         1              Queue            8    12
41
42 RES          1          15  Table           13
43
44 LIMIT        1           4  Integer          5    17
45
46
47
48 STORAGE REQUIREMENTS (BYTES)
49
50 COMPILED CODE:      392
51 COMPILED DATA:       40
52 MISCELLANEOUS:        0
53 ENTITIES:           600
54 COMMON:           10000
55 ----------------------
56 TOTAL:            11032
57
58
59
60 GPSS/H MODEL SIZE:
61
62 CONTROL STATEMENTS      5
63 BLOCKS                  8
64
65
66
67 Simulation begins.
68
```

```
RELATIVE CLOCK: 10043.1970   ABSOLUTE CLOCK: 10043.1970



BLOCK CURRENT     TOTAL
1                  1000
2                  1000
3                  1000
4                  1000
5                  1000
6                  1000
7                  1000
8                  1000



          --AVG-UTIL-DURING--
FACILITY  TOTAL  AVAIL  UNAVL     ENTRIES    AVERAGE   CURRENT  PERCENT
… SEIZING  PREEMPTING
           TIME   TIME   TIME               TIME/XACT   STATUS   AVAIL
… XACT      XACT
CHECKOUT  0.708                    1000       7.107    AVAIL


   QUEUE     MAXIMUM      AVERAGE       TOTAL        ZERO     PERCENT
… AVERAGE      $AVERAGE     QTABLE     CURRENT
            CONTENTS     CONTENTS      ENTRIES     ENTRIES     ZEROS
… TIME/UNIT    TIME/UNIT     NUMBER    CONTENTS
    LINE           3        0.830        1000           0
… 8.340         8.340                     0


TABLE      RES

ENTRIES IN TABLE   MEAN ARGUMENT   STANDARD DEVIATION   SUM OF ARGUMENTS
       1000.0000          8.3397               3.8653          8339.6682
… NON-WEIGHTED

       UPPER    OBSERVED     PERCENT  CUMULATIVE  CUMULATIVE    MULTIPLE
… DEVIATION
       LIMIT   FREQUENCY    OF TOTAL  PERCENTAGE   REMAINDER     OF MEAN
… FROM MEAN
      5.0000    210.0000     21.0000       21.00       79.00      0.5995
… -0.8640
```

```
     10.0000    468.0000     46.8000       67.80       32.20       1.1991
… 0.4295
     15.0000    268.0000     26.8000       94.60        5.40       1.7986
… 1.7231
     20.0000     46.0000      4.6000       99.20        0.80       2.3982
… 3.0166
     25.0000      7.0000      0.7000       99.90        0.10       2.9977
… 4.3102
     30.0000      1.0000      0.1000      100.00        0.00       3.5973
… 5.6037



  RANDOM    ANTITHETIC     INITIAL     CURRENT      SAMPLE   CHI-SQUARE
  STREAM      VARIATES    POSITION    POSITION       COUNT   UNIFORMITY
       1           OFF      100000      102001        2001         0.54



STATUS OF COMMON STORAGE

    9744 BYTES AVAILABLE
     256 IN USE
     640 USED (MAX)
```

```
127
128 Simulation terminated.  Absolute Clock: 10043.1970
129
130
131
132 Total Block Executions: 8000
133
134 Blocks / second:        8000000
135
136 Microseconds / Block:   0.13
137
138
139
140 Elapsed Time Used (SEC)
141
142 PASS1:           0.06
143 LOAD/CTRL:       0.16
144 EXECUTION:       0.00
145 --------------------
146 TOTAL:           0.22
147
148 GPSS/H IS A PROPRIETARY PRODUCT OF, AND IS USED UNDER A LICENSE GRANTED BY
  … THE WOLVERINE SOFTWARE CORPORATION,
149 4115 ANNANDALE ROAD, ANNANDALE, VIRGINIA 22003-2500, USA.
150
```