COIS 4470H - Assignment #2 - GPSS Code + Answers - Brianna Drew (#0622446)

1. a)

```
          SIMULATE
*         Define Ampervariables
          INTEGER    &LIMIT
          LET        &LIMIT=10000
*         Block Statements
          GENERATE   RVEXPO(1,5)
          QUEUE      LINE
          SEIZE      TELLER
          DEPART     LINE
          ADVANCE    RVEXPO(2,3)
          RELEASE    TELLER
          TERMINATE  1
          START      &LIMIT
          END
```

The mean waiting time for the 10,000 customers was 4.72 minutes (7.862 minutes for those who had to wait) and the teller was idle for 40.5% of the time.

b)

```
          SIMULATE
*         Define Ampervariables
          INTEGER    &LIMIT
          LET        &LIMIT=10000
*         Block Statements
          GENERATE   RVEXPO(1,4)
          QUEUE      LINE
          SEIZE      TELLER
          DEPART     LINE
          ADVANCE    RVEXPO(2,3)
          RELEASE    TELLER
          TERMINATE  1
          START      &LIMIT
          END
```

In increasing the rate at which the customers arrive from 0.2 to 0.25, this has increased the mean waiting time to 9.477 minutes (12.603 minutes for those who had to wait) and the teller has a lower idle time, being idle for only 25.6% of the time now.

c)

```
          SIMULATE
*         Define Ampervariables
          INTEGER    &LIMIT
          LET        &LIMIT=10000
*         Block Statements
```

```
          GENERATE   RVEXPO(1,10)
          QUEUE      LINE
          SEIZE      TELLER
          DEPART     LINE
          ADVANCE    RVEXPO(2,3)
          RELEASE    TELLER
          TERMINATE  1
          START      &LIMIT
          END
```

In decreasing the rate at which the customers arrive from 0.2 to 0.1, this had decreased the mean waiting time to 1.304 minutes (4.374 minutes for those who had to wait) and the teller has a higher idle time, being idle for 70.2% of the time now.

d)

```
          SIMULATE
*         Define Ampervariables
          INTEGER    &LIMIT
          LET        &LIMIT=10000
*         Block Statements
          GENERATE   RVEXPO(1,5)
          QUEUE      LINE
          ENTER      1,1
          DEPART     LINE
          ADVANCE    RVEXPO(2,4)
          LEAVE      1,1
          STORAGE    S1,2
          TERMINATE  1
          START      &LIMIT
          END
```

In adding a second teller to the system but increasing the mean number of minutes it takes to process a customer to 4, this has decreased the mean waiting time even further to 0.795 minutes (3.505 minutes for those who had to wait) and has also increased the total idle time for the tellers to 60.3%.

2.

```
          SIMULATE
          INITIAL    X2,15
* Define Ampervariables
          INTEGER    &LIMIT
          LET        &LIMIT=60000
* Block Statements
          GENERATE   RVEXPO(1,X2)
          TRANSFER   .25,FEM,MAL
 FEM      QUEUE      FEMALE
          ENTER      1,1
          DEPART     FEMALE
          ADVANCE    10,3
          LEAVE      1,1
          TRANSFER   ,SKIP
 MAL      QUEUE      MALE
```

```
           SEIZE      MALE
           DEPART     MALE
           ADVANCE    8,2
           RELEASE    MALE
 SKIP      TERMINATE
*
           STORAGE    S1,2
*
           GENERATE   &LIMIT
           TERMINATE  1
           START      1
           END
```

The mean waiting time for males was 0.532 minutes (4.444 minutes for those who had to wait) and the mean waiting time for females was 0.417 minutes (4.109 minutes for those who had to wait). The utilization for the male barber was 13.3% and the utilization for the female barbers was 25.2%.

```
           SIMULATE
           INITIAL    X2,15
* Define Ampervariables
           INTEGER    &LIMIT
           LET        &LIMIT=60000
* Block Statements
           GENERATE   RVEXPO(1,X2)
           TRANSFER   .50,FEM,MAL
 FEM       QUEUE      FEMALE
           ENTER      1,1
           DEPART     FEMALE
           ADVANCE    10,3
           LEAVE      1,1
           TRANSFER   ,SKIP
 MAL       QUEUE      MALE
           SEIZE      MALE
           DEPART     MALE
           ADVANCE    8,2
           RELEASE    MALE
 SKIP      TERMINATE
*
           STORAGE    S1,2
*
           GENERATE   &LIMIT
           TERMINATE  1
           START      1
           END
```

When customer distribution shifts to 50/50, the mean waiting time for males increased to 1.370 minutes (5.267 minutes for those who had to wait) and the mean waiting time for females decreased to 0.158 minutes (3.456 minutes for those who had to wait). The utilization for the male barber increased to 26.7% and the utilization for the female barbers decreased to 17%.

```
           SIMULATE
           INITIAL    X2,15
* Define Ampervariables
           INTEGER    &LIMIT
           LET        &LIMIT=60000
```

```
* Block Statements
          GENERATE   RVEXPO(1,X2)
          TRANSFER   .75,FEM,MAL
 FEM      QUEUE      FEMALE
          ENTER      1,1
          DEPART     FEMALE
          ADVANCE    10,3
          LEAVE      1,1
          TRANSFER   ,SKIP
 MAL      QUEUE      MALE
          SEIZE      MALE
          DEPART     MALE
          ADVANCE    8,2
          RELEASE    MALE
 SKIP     TERMINATE
*
          STORAGE    S1,2
*
          GENERATE   &LIMIT
          TERMINATE  1
          START      1
          END
```

When customer distribution shifts to 75% male and 25% female, the mean waiting time for males increases even more to 2.654 minutes (6.73 minutes for those who had to wait) and the mean waiting time for females decreases even more to 0.024 minutes (2.417 minutes for those who had to wait). The utilization for the male barber increased even more to 40.1% and the utilization for the female barbers decreased even more to 8.4%.

3.

```
          SIMULATE
* Define Ampervariables
          INTEGER    &LIMIT
          REAL       &IAT
          LET        &LIMIT=100
          LET        &IAT=.208333
* Block Statements
          GENERATE   RVEXPO(1,&IAT)
          QUEUE      TOTAL
          TRANSFER   .6,NEW,OLD
 NEW      QUEUE      NEWER
          ENTER      1,1
          SEIZE      TUG
          ADVANCE    .0208333,.00694444
          RELEASE    TUG
          ADVANCE    .8,.1
          DEPART     NEWER
          LEAVE      1,1
          TRANSFER   ,FIN
 OLD      QUEUE      OLDER
          ENTER      2,1
          SEIZE      TUG
```

```
          ADVANCE    .0208333,.00694444
          RELEASE    TUG
          ADVANCE    1.5,.2
          DEPART     OLDER
          LEAVE      2,1
 FIN      DEPART     TOTAL
          TERMINATE
*
          STORAGE    S1,2/S2,4
*
          GENERATE   &LIMIT
          TERMINATE  1
          START      1
          END
```

The mean response time for ships in Complex 1 was 1.343 days, the mean response time for ships in Complex 2 was 4.059 days, and the mean response time for all ships was 2.946 days.

4.

```
          SIMULATE
          INITIAL    X4,32/X5,25/X6,28
* Define Ampervariables
          INTEGER    &LIMIT
          REAL       &IAT
          LET        &LIMIT=120000
          LET        &IAT=6
* Block Statements
          GENERATE   RVEXPO(1,&IAT)
          SEIZE      TRIAGE
          ADVANCE    5,2
          RELEASE    TRIAGE
          TRANSFER   .7,ERR,REG
 ERR      SEIZE      SERIOUS
          ADVANCE    20,3
          RELEASE    SERIOUS
          TRANSFER   ,DIS
 REG      SELECT MIN 5,4,6,,Q
          QUEUE      *5
          SEIZE      *5
          DEPART     *5
          ADVANCE    RVEXPO(2,X*5)
          RELEASE    *5
 DIS      SEIZE      DISCHARG
          ADVANCE    7,1
          RELEASE    DISCHARG
          TABULATE   RES
          TERMINATE

          GENERATE   &LIMIT
 RES      TABLE      M1,60,30,10
          TERMINATE  1
          START      1
          END
```

Table of response times for government auditors:

```
Table      RES

Entries in Table   Mean Argument   Standard Deviation   Sum of Arguments
      15627.0000        105.8021              62.5662         1.6534E+06
Non-Weighted

       Upper    Observed     Percent  Cumulative  Cumulative    Multiple
Deviation
       Limit   Frequency    of Total  Percentage   Remainder     of Mean
From Mean
     60.0000   3711.0000     23.7474       23.75       76.25      0.5671
-0.7321
     90.0000   3813.0000     24.4001       48.15       51.85      0.8506
-0.2526
    120.0000   3136.0000     20.0678       68.22       31.78      1.1342
0.2269
    150.0000   2045.0000     13.0863       81.30       18.70      1.4177
0.7064
    180.0000   1214.0000      7.7686       89.07       10.93      1.7013
1.1859
    210.0000    702.0000      4.4922       93.56        6.44      1.9848
1.6654
    240.0000    400.0000      2.5597       96.12        3.88      2.2684
2.1449
    270.0000    247.0000      1.5806       97.70        2.30      2.5519
2.6244
    300.0000    135.0000      0.8639       98.57        1.43      2.8355
3.1039
    Overflow    224.0000        1.43      100.00        0.00

Average value of overflow is     363.9743
•
Non-zero Fullword Savevalues:  (NAME : VALUE)

       4:          32,        5:          25,        6:          28



  Random    Antithetic     Initial     Current      Sample   Chi-Square
  Stream      Variates    Position    Position       Count   Uniformity
       1           OFF      100000      167324       67324      0.92
       2           OFF      200000      210860       10860      0.73
```