# Customers = Busy day

```
# --- 1. CONFIGURATION ---
SIM_DURATION = 16 * 60      # 960 Minutes (e.g., 7:00 AM to 11:00 PM)
CLOSE_TIME = 16 * 60
MORNING_TIME = 4.0 * 60     # 11:00 AM
LUNCH_TIME = 8.0 * 60       # 3:00 PM

# Staffing
NUM_CASHIERS = 1
NUM_COOKS = 3
NUM_BARISTAS = 2
NUM_PACKERS = 1
NUM_BUSSERS = 1

# Capacities
SHELF_CAPACITY = 10
DRIVE_THRU_LANE_SIZE = 10
URN_BATCH_SIZE = 50
NUM_TABLES = 10


================================================================================
STARTING CRN SIMULATION (Same Customers, Different Internal Events)
Customer Seed: 42 | Replication Seeds: [1, 2, 5, 30, 42]
================================================================================
>>> GENERATING MASTER WORKLOAD (Seed 42)...
    Generated 1017 customers.

>>> RUNNING REPLICATION WITH INTERNAL SEED 1...

--- STARTING INTEGRATED SIMULATION (LANE CAP: 10) ---
[Time 100.09] ESPRESSO MACHINE MAINTENANCE STARTED (8.75 min).
[Time 108.84] ESPRESSO MACHINE ONLINE.
[Time 691.51] ESPRESSO MACHINE MAINTENANCE STARTED (8.57 min).
[Time 700.09] ESPRESSO MACHINE ONLINE.


================================================================================
                         FINAL STATISTICS -- SEED 1
================================================================================
THROUGHPUT:
   Walk-In:    328
   Drive-Thru: 433
   Mobile:     219
   TOTAL:      980
--------------------------------------------------------------------------------
WAIT TIMES (Arrival -> Food Ready/Depart) [Minutes]:
   CHANNEL      AVG         MAX         95th %ILE
   Walk-In      6.66        19.74       15.36
   Drive-Thru   6.60        18.12       15.67
   Mobile       5.91        16.32       14.38
--------------------------------------------------------------------------------
LOSS ANALYSIS:
   Drive-Thru Balks: 37
   Mobile Reneges:   16
   Food Waste Cost:  $22.85
--------------------------------------------------------------------------------
FINANCIALS:
   Gross Revenue:   $10,169.60
   Food Costs:      $1,322.45
   Labor Cost:      $2,541.60 (9 Staff)
   Penalties:       $556.70
   NET PROFIT:      $5,748.85
--------------------------------------------------------------------------------
RESOURCE UTILIZATION:
   STATION     BUSY TIME (m)    CAPACITY    UTIL %
   URN         216.31           2           11.27
   ESPRESSO    571.54           2           29.77
   FOOD        1343.35          3           46.64
   PACKER      631.97           1           65.83
```

```
   SEATING    2508.01      10          26.13
   BUSSER     90.50        1           9.43
================================================================================

>>> RUNNING REPLICATION WITH INTERNAL SEED 2...

--- STARTING INTEGRATED SIMULATION (LANE CAP: 10) ---
[Time 24.89] ESPRESSO MACHINE MAINTENANCE STARTED (8.55 min).
[Time 33.44] ESPRESSO MACHINE ONLINE.
[Time 104.64] ESPRESSO MACHINE MAINTENANCE STARTED (2.03 min).
[Time 106.67] ESPRESSO MACHINE ONLINE.


================================================================================
                         FINAL STATISTICS -- SEED 2
================================================================================
THROUGHPUT:
  Walk-In:   328
  Drive-Thru: 429
  Mobile:    219
  TOTAL:     976
--------------------------------------------------------------------------------
WAIT TIMES (Arrival -> Food Ready/Depart) [Minutes]:
  CHANNEL     AVG       MAX        95th %ILE
  Walk-In     6.94      20.50      15.69
  Drive-Thru  6.64      22.28      15.19
  Mobile      6.13      18.00      14.26
--------------------------------------------------------------------------------
LOSS ANALYSIS:
  Drive-Thru Balks: 41
  Mobile Reneges:   15
  Food Waste Cost:  $20.75
--------------------------------------------------------------------------------
FINANCIALS:
  Gross Revenue:   $10,101.60
  Food Costs:      $1,312.30
  Labor Cost:      $2,541.60 (9 Staff)
  Penalties:       $605.10
  NET PROFIT:      $5,642.60
--------------------------------------------------------------------------------
RESOURCE UTILIZATION:
  STATION     BUSY TIME (m)   CAPACITY    UTIL %
  URN         211.92          2           11.04
  ESPRESSO    568.79          2           29.62
  FOOD        1342.79         3           46.62
  PACKER      625.44          1           65.15
  SEATING     2779.41         10          28.95
  BUSSER      90.50           1           9.43
================================================================================

>>> RUNNING REPLICATION WITH INTERNAL SEED 5...

--- STARTING INTEGRATED SIMULATION (LANE CAP: 10) ---
[Time 53.28] ESPRESSO MACHINE MAINTENANCE STARTED (9.82 min).
[Time 63.10] ESPRESSO MACHINE ONLINE.
[Time 835.90] ESPRESSO MACHINE MAINTENANCE STARTED (3.71 min).
[Time 839.61] ESPRESSO MACHINE ONLINE.


================================================================================
                         FINAL STATISTICS -- SEED 5
================================================================================
THROUGHPUT:
  Walk-In:   328
  Drive-Thru: 443
  Mobile:    219
  TOTAL:     990
--------------------------------------------------------------------------------
WAIT TIMES (Arrival -> Food Ready/Depart) [Minutes]:
  CHANNEL     AVG       MAX        95th %ILE
  Walk-In     6.31      20.12      16.48
  Drive-Thru  6.06      19.59      16.09
  Mobile      5.79      19.04      15.85
--------------------------------------------------------------------------------
LOSS ANALYSIS:
```

```
   Drive-Thru Balks: 27
   Mobile Reneges:  20
   Food Waste Cost: $28.70
--------------------------------------------------------------------------------
FINANCIALS:
   Gross Revenue:   $10,261.40
   Food Costs:      $1,340.00
   Labor Cost:      $2,541.60 (9 Staff)
   Penalties:       $506.50
   NET PROFIT:      $5,873.30
--------------------------------------------------------------------------------
RESOURCE UTILIZATION:
   STATION    BUSY TIME (m)   CAPACITY    UTIL %
   URN        213.25          2           11.11
   ESPRESSO   554.64          2           28.89
   FOOD       1367.55         3           47.48
   PACKER     633.43          1           65.98
   SEATING    2865.71         10          29.85
   BUSSER     90.50           1           9.43
================================================================================

>>> RUNNING REPLICATION WITH INTERNAL SEED 30...

--- STARTING INTEGRATED SIMULATION (LANE CAP: 10) ---
[Time 154.59] ESPRESSO MACHINE MAINTENANCE STARTED (8.80 min).
[Time 163.39] ESPRESSO MACHINE ONLINE.
[Time 365.52] ESPRESSO MACHINE MAINTENANCE STARTED (2.21 min).
[Time 367.73] ESPRESSO MACHINE ONLINE.

================================================================================
                        FINAL STATISTICS -- SEED 30
================================================================================
THROUGHPUT:
   Walk-In:    328
   Drive-Thru: 449
   Mobile:     219
   TOTAL:      996
--------------------------------------------------------------------------------
WAIT TIMES (Arrival -> Food Ready/Depart) [Minutes]:
   CHANNEL     AVG        MAX        95th %ILE
   Walk-In     5.72       17.82      14.58
   Drive-Thru  5.81       18.49      13.70
   Mobile      5.04       17.99      13.43
--------------------------------------------------------------------------------
LOSS ANALYSIS:
   Drive-Thru Balks: 21
   Mobile Reneges:   8
   Food Waste Cost: $11.65
--------------------------------------------------------------------------------
FINANCIALS:
   Gross Revenue:   $10,295.50
   Food Costs:      $1,327.95
   Labor Cost:      $2,541.60 (9 Staff)
   Penalties:       $347.20
   NET PROFIT:      $6,078.75
--------------------------------------------------------------------------------
RESOURCE UTILIZATION:
   STATION    BUSY TIME (m)   CAPACITY    UTIL %
   URN        221.22          2           11.52
   ESPRESSO   565.52          2           29.45
   FOOD       1359.10         3           47.19
   PACKER     616.04          1           64.17
   SEATING    2946.04         10          30.69
   BUSSER     90.50           1           9.43
================================================================================

>>> RUNNING REPLICATION WITH INTERNAL SEED 42...

--- STARTING INTEGRATED SIMULATION (LANE CAP: 10) ---
[Time 89.89] ESPRESSO MACHINE MAINTENANCE STARTED (6.68 min).
[Time 96.57] ESPRESSO MACHINE ONLINE.
[Time 912.69] ESPRESSO MACHINE MAINTENANCE STARTED (7.30 min).
[Time 919.98] ESPRESSO MACHINE ONLINE.
```

```
================================================================================
                        FINAL STATISTICS -- SEED 42
================================================================================
THROUGHPUT:
  Walk-In:   328
  Drive-Thru: 445
  Mobile:    219
  TOTAL:     992
--------------------------------------------------------------------------------
WAIT TIMES (Arrival -> Food Ready/Depart) [Minutes]:
  CHANNEL     AVG        MAX        95th %ILE
  Walk-In    6.14       17.74      14.79
  Drive-Thru 6.02       18.96      13.61
  Mobile     5.46       16.99      14.21
--------------------------------------------------------------------------------
LOSS ANALYSIS:
  Drive-Thru Balks: 25
  Mobile Reneges:   10
  Food Waste Cost:  $16.75
--------------------------------------------------------------------------------
FINANCIALS:
  Gross Revenue:   $10,270.90
  Food Costs:      $1,329.15
  Labor Cost:      $2,541.60 (9 Staff)
  Penalties:       $403.20
  NET PROFIT:      $5,996.95
--------------------------------------------------------------------------------
RESOURCE UTILIZATION:
  STATION    BUSY TIME (m)  CAPACITY   UTIL %
  URN        217.29         2          11.32
  ESPRESSO   565.58         2          29.46
  FOOD       1395.12        3          48.44
  PACKER     623.81         1          64.98
  SEATING    2258.84        10         23.53
  BUSSER     90.50          1          9.43
================================================================================

################################################################################
                      CROSS-REPLICATION SUMMARY (5 RUNS)
################################################################################
METRIC            MEAN          95% CI (+/-)
------------------------------------------------------------
Net Profit        $5868.09      $220.40
Throughput        986.8         10.5
Avg Wait (All)    6.14          0.51
95% Tail Wait     15.08         1.10
------------------------------------------------------------
Avg Balks/Day:   30.2
Avg Reneges/Day: 13.8
================================================================================
```

```
SIM_DURATION = 16 * 60      # 960 Minutes (e.g., 7:00 AM to 11:00 PM)
CLOSE_TIME = 16 * 60
MORNING_TIME = 4.0 * 60     # 11:00 AM
LUNCH_TIME = 8.0 * 60       # 3:00 PM


# Staffing
NUM_CASHIERS = 1
NUM_COOKS = 3
NUM_BARISTAS = 2
NUM_PACKERS = 1
NUM_BUSSERS = 1

# Capacities
SHELF_CAPACITY = 6
DRIVE_THRU_LANE_SIZE = 6
URN_BATCH_SIZE = 50
NUM_TABLES = 10



================================================================================
STARTING CRN SIMULATION (Same Customers, Different Internal Events)
Customer Seed: 42 | Replication Seeds: [1, 2, 5, 30, 42]
================================================================================
>>> GENERATING MASTER WORKLOAD (Seed 42)...
    Generated 1017 customers.

>>> RUNNING REPLICATION WITH INTERNAL SEED 1...

--- STARTING INTEGRATED SIMULATION (LANE CAP: 10) ---
[Time 100.09] ESPRESSO MACHINE MAINTENANCE STARTED (8.75 min).
[Time 108.84] ESPRESSO MACHINE ONLINE.
[Time 691.51] ESPRESSO MACHINE MAINTENANCE STARTED (12.76 min).
[Time 704.27] ESPRESSO MACHINE ONLINE.

================================================================================
                          FINAL STATISTICS -- SEED 1
================================================================================
THROUGHPUT:
  Walk-In:    328
  Drive-Thru: 428
  Mobile:     219
  TOTAL:      975
--------------------------------------------------------------------------------
WAIT TIMES (Arrival -> Food Ready/Depart) [Minutes]:
  CHANNEL     AVG         MAX         95th %ILE
  Walk-In     7.06        19.68       17.16
  Drive-Thru  7.08        21.37       16.51
  Mobile      6.31        19.94       16.03
--------------------------------------------------------------------------------
LOSS ANALYSIS:
  Drive-Thru Balks: 42
  Mobile Reneges:   50
  Food Waste Cost:  $72.55
--------------------------------------------------------------------------------
FINANCIALS:
  Gross Revenue:    $10,125.80
  Food Costs:       $1,368.75
  Labor Cost:       $2,259.20 (8 Staff)
  Penalties:        $970.30
  NET PROFIT:       $5,527.55
--------------------------------------------------------------------------------
RESOURCE UTILIZATION:
  STATION     BUSY TIME (m)   CAPACITY    UTIL %
  URN         219.58          2           11.44
  ESPRESSO    575.30          2           29.96
  FOOD        1338.43         3           46.47
  PACKER      610.82          1           63.63
  SEATING     2726.67         10          28.40
  BUSSER      90.50           1           9.43
================================================================================

>>> RUNNING REPLICATION WITH INTERNAL SEED 2...
```

```
--- STARTING INTEGRATED SIMULATION (LANE CAP: 10) ---
[Time 24.89] ESPRESSO MACHINE MAINTENANCE STARTED (8.55 min).
[Time 33.44] ESPRESSO MACHINE ONLINE.
[Time 104.64] ESPRESSO MACHINE MAINTENANCE STARTED (2.03 min).
[Time 106.67] ESPRESSO MACHINE ONLINE.


================================================================================
                        FINAL STATISTICS -- SEED 2
================================================================================
THROUGHPUT:
  Walk-In:   328
  Drive-Thru: 422
  Mobile:    219
  TOTAL:     969
--------------------------------------------------------------------------------
WAIT TIMES (Arrival -> Food Ready/Depart) [Minutes]:
  CHANNEL      AVG       MAX       95th %ILE
  Walk-In      7.48      23.64     18.39
  Drive-Thru   7.09      23.56     17.96
  Mobile       6.91      22.11     18.02
--------------------------------------------------------------------------------
LOSS ANALYSIS:
  Drive-Thru Balks: 48
  Mobile Reneges:   51
  Food Waste Cost:  $72.90
--------------------------------------------------------------------------------
FINANCIALS:
  Gross Revenue:    $10,020.50
  Food Costs:       $1,354.55
  Labor Cost:       $2,259.20 (8 Staff)
  Penalties:        $1,096.00
  NET PROFIT:       $5,310.75
--------------------------------------------------------------------------------
RESOURCE UTILIZATION:
  STATION     BUSY TIME (m)   CAPACITY    UTIL %
  URN         201.65          2           10.50
  ESPRESSO    565.19          2           29.44
  FOOD        1357.70         3           47.14
  PACKER      601.91          1           62.70
  SEATING     3141.45         10          32.72
  BUSSER      90.50           1           9.43
================================================================================

>>> RUNNING REPLICATION WITH INTERNAL SEED 5...

--- STARTING INTEGRATED SIMULATION (LANE CAP: 10) ---
[Time 53.28] ESPRESSO MACHINE MAINTENANCE STARTED (9.82 min).
[Time 63.10] ESPRESSO MACHINE ONLINE.
[Time 835.90] ESPRESSO MACHINE MAINTENANCE STARTED (12.89 min).
[Time 848.80] ESPRESSO MACHINE ONLINE.


================================================================================
                        FINAL STATISTICS -- SEED 5
================================================================================
THROUGHPUT:
  Walk-In:   328
  Drive-Thru: 423
  Mobile:    219
  TOTAL:     970
--------------------------------------------------------------------------------
WAIT TIMES (Arrival -> Food Ready/Depart) [Minutes]:
  CHANNEL      AVG       MAX       95th %ILE
  Walk-In      7.93      20.44     17.61
  Drive-Thru   7.42      20.01     16.65
  Mobile       6.99      18.86     15.57
--------------------------------------------------------------------------------
LOSS ANALYSIS:
  Drive-Thru Balks: 47
  Mobile Reneges:   64
  Food Waste Cost:  $87.65
--------------------------------------------------------------------------------
FINANCIALS:
  Gross Revenue:    $10,036.00
```

```
  Food Costs:       $1,368.00
  Labor Cost:       $2,259.20 (8 Staff)
  Penalties:        $1,189.00
  NET PROFIT:       $5,219.80
--------------------------------------------------------------------------------
RESOURCE UTILIZATION:
  STATION     BUSY TIME (m)   CAPACITY    UTIL %
  URN         213.20          2           11.10
  ESPRESSO    568.01          2           29.58
  FOOD        1317.77         3           45.76
  PACKER      616.45          1           64.21
  SEATING     2265.02         10          23.59
  BUSSER      90.50           1           9.43
================================================================================

>>> RUNNING REPLICATION WITH INTERNAL SEED 30...

--- STARTING INTEGRATED SIMULATION (LANE CAP: 10) ---
[Time 154.59] ESPRESSO MACHINE MAINTENANCE STARTED (8.80 min).
[Time 163.39] ESPRESSO MACHINE ONLINE.
[Time 365.52] ESPRESSO MACHINE MAINTENANCE STARTED (12.32 min).
[Time 377.84] ESPRESSO MACHINE ONLINE.

================================================================================
                        FINAL STATISTICS -- SEED 30
================================================================================
THROUGHPUT:
  Walk-In:    328
  Drive-Thru: 428
  Mobile:     219
  TOTAL:      975
--------------------------------------------------------------------------------
WAIT TIMES (Arrival -> Food Ready/Depart) [Minutes]:
  CHANNEL      AVG        MAX        95th %ILE
  Walk-In      7.03       19.78      15.65
  Drive-Thru   6.65       21.00      14.89
  Mobile       5.91       18.24      14.40
--------------------------------------------------------------------------------
LOSS ANALYSIS:
  Drive-Thru Balks: 42
  Mobile Reneges:   48
  Food Waste Cost:  $72.05
--------------------------------------------------------------------------------
FINANCIALS:
  Gross Revenue:    $10,085.40
  Food Costs:       $1,362.50
  Labor Cost:       $2,259.20 (8 Staff)
  Penalties:        $1,015.00
  NET PROFIT:       $5,448.70
--------------------------------------------------------------------------------
RESOURCE UTILIZATION:
  STATION     BUSY TIME (m)   CAPACITY    UTIL %
  URN         205.80          2           10.72
  ESPRESSO    560.30          2           29.18
  FOOD        1342.54         3           46.62
  PACKER      612.30          1           63.78
  SEATING     2694.95         10          28.07
  BUSSER      90.50           1           9.43
================================================================================

>>> RUNNING REPLICATION WITH INTERNAL SEED 42...

--- STARTING INTEGRATED SIMULATION (LANE CAP: 10) ---
[Time 89.89] ESPRESSO MACHINE MAINTENANCE STARTED (6.68 min).
[Time 96.57] ESPRESSO MACHINE ONLINE.
[Time 912.69] ESPRESSO MACHINE MAINTENANCE STARTED (8.29 min).
[Time 920.98] ESPRESSO MACHINE ONLINE.

================================================================================
                        FINAL STATISTICS -- SEED 42
================================================================================
THROUGHPUT:
  Walk-In:    328
```

```
  Drive-Thru: 435
  Mobile:      219
  TOTAL:       982
--------------------------------------------------------------------------
WAIT TIMES (Arrival -> Food Ready/Depart) [Minutes]:
  CHANNEL      AVG        MAX        95th %ILE
  Walk-In      6.91       18.98      15.46
  Drive-Thru   6.79       19.74      14.97
  Mobile       6.25       17.37      14.46
--------------------------------------------------------------------------
LOSS ANALYSIS:
  Drive-Thru Balks: 35
  Mobile Reneges:   47
  Food Waste Cost: $67.10
--------------------------------------------------------------------------
FINANCIALS:
  Gross Revenue:   $10,181.40
  Food Costs:      $1,368.80
  Labor Cost:      $2,259.20 (8 Staff)
  Penalties:       $893.40
  NET PROFIT:      $5,660.00
--------------------------------------------------------------------------
RESOURCE UTILIZATION:
  STATION     BUSY TIME (m)   CAPACITY    UTIL %
  URN         215.75          2           11.24
  ESPRESSO    565.91          2           29.47
  FOOD        1365.96         3           47.43
  PACKER      623.10          1           64.91
  SEATING     2845.85         10          29.64
  BUSSER      90.50           1           9.43
==========================================================================

##########################################################################
                    CROSS-REPLICATION SUMMARY (5 RUNS)
##########################################################################
METRIC              MEAN          95% CI (+/-)
------------------------------------------------------------
Net Profit          $5433.36      $216.02
Throughput          974.2         6.4
Avg Wait (All)      6.98          0.45
95% Tail Wait       16.36         1.69
------------------------------------------------------------
Avg Balks/Day:   42.8
Avg Reneges/Day: 52.0
==========================================================================
```

```
# Staffing
NUM_CASHIERS = 1
NUM_COOKS = 2
NUM_BARISTAS = 2
NUM_PACKERS = 1
NUM_BUSSERS = 1

# Capacities
SHELF_CAPACITY = 10
DRIVE_THRU_LANE_SIZE = 10
URN_BATCH_SIZE = 50
NUM_TABLES = 10


================================================================================
STARTING CRN SIMULATION (Same Customers, Different Internal Events)
Customer Seed: 42 | Replication Seeds: [1, 2, 5, 30, 42]
================================================================================
>>> GENERATING MASTER WORKLOAD (Seed 42)...
    Generated 1017 customers.


>>> RUNNING REPLICATION WITH INTERNAL SEED 1...

--- STARTING INTEGRATED SIMULATION (LANE CAP: 8) ---
[Time 100.09] ESPRESSO MACHINE MAINTENANCE STARTED (4.89 min).
[Time 104.97] ESPRESSO MACHINE ONLINE.
[Time 691.51] ESPRESSO MACHINE MAINTENANCE STARTED (6.35 min).
[Time 697.87] ESPRESSO MACHINE ONLINE.


================================================================================
                          FINAL STATISTICS -- SEED 1
================================================================================
THROUGHPUT:
  Walk-In:    328
  Drive-Thru: 418
  Mobile:     219
  TOTAL:      965
--------------------------------------------------------------------------------
WAIT TIMES (Arrival -> Food Ready/Depart) [Minutes]:
  CHANNEL     AVG        MAX        95th %ILE
  Walk-In     6.25       17.17      13.71
  Drive-Thru  6.16       16.90      12.85
  Mobile      4.99       15.68      12.36
--------------------------------------------------------------------------------
LOSS ANALYSIS:
  Drive-Thru Balks: 52
  Mobile Reneges:   18
  Food Waste Cost:  $30.85
--------------------------------------------------------------------------------
FINANCIALS:
  Gross Revenue:   $9,925.60
  Food Costs:      $1,299.75
  Labor Cost:      $1,976.80 (7 Staff)
  Penalties:       $842.30
  NET PROFIT:      $5,806.75
--------------------------------------------------------------------------------
RESOURCE UTILIZATION:
  STATION     BUSY TIME (m)   CAPACITY   UTIL %
  URN         218.56          2          11.38
  ESPRESSO    540.04          2          28.13
  FOOD        1332.41         2          69.40
  PACKER      620.67          1          64.65
  SEATING     2814.33         10         29.32
  BUSSER      90.50           1          9.43
================================================================================

>>> RUNNING REPLICATION WITH INTERNAL SEED 2...
```

```
--- STARTING INTEGRATED SIMULATION (LANE CAP: 8) ---
[Time 24.89] ESPRESSO MACHINE MAINTENANCE STARTED (8.55 min).
[Time 33.44] ESPRESSO MACHINE ONLINE.
[Time 104.64] ESPRESSO MACHINE MAINTENANCE STARTED (12.93 min).
[Time 117.57] ESPRESSO MACHINE ONLINE.

================================================================================
                         FINAL STATISTICS -- SEED 2
================================================================================
THROUGHPUT:
  Walk-In:    328
  Drive-Thru: 417
  Mobile:     219
  TOTAL:      964
--------------------------------------------------------------------------------
WAIT TIMES (Arrival -> Food Ready/Depart) [Minutes]:
  CHANNEL     AVG        MAX        95th %ILE
  Walk-In     6.50       19.63      14.30
  Drive-Thru  6.17       17.23      12.30
  Mobile      5.04       17.24      11.84
--------------------------------------------------------------------------------
LOSS ANALYSIS:
  Drive-Thru Balks: 53
  Mobile Reneges:   16
  Food Waste Cost:  $22.20
--------------------------------------------------------------------------------
FINANCIALS:
  Gross Revenue:    $9,967.00
  Food Costs:       $1,295.95
  Labor Cost:       $1,976.80 (7 Staff)
  Penalties:        $742.90
  NET PROFIT:       $5,951.35
--------------------------------------------------------------------------------
RESOURCE UTILIZATION:
  STATION     BUSY TIME (m)   CAPACITY   UTIL %
  URN         211.60          2          11.02
  ESPRESSO    552.64          2          28.78
  FOOD        1337.80         2          69.68
  PACKER      616.36          1          64.20
  SEATING     2696.55         10         28.09
  BUSSER      90.50           1          9.43
================================================================================

>>> RUNNING REPLICATION WITH INTERNAL SEED 5...

--- STARTING INTEGRATED SIMULATION (LANE CAP: 8) ---
[Time 53.28] ESPRESSO MACHINE MAINTENANCE STARTED (9.82 min).
[Time 63.10] ESPRESSO MACHINE ONLINE.
[Time 835.90] ESPRESSO MACHINE MAINTENANCE STARTED (6.07 min).
[Time 841.97] ESPRESSO MACHINE ONLINE.

================================================================================
                         FINAL STATISTICS -- SEED 5
================================================================================
THROUGHPUT:
  Walk-In:    328
  Drive-Thru: 424
  Mobile:     219
  TOTAL:      971
--------------------------------------------------------------------------------
WAIT TIMES (Arrival -> Food Ready/Depart) [Minutes]:
  CHANNEL     AVG        MAX        95th %ILE
  Walk-In     5.87       16.07      12.86
```

```
  Drive-Thru   5.84        15.50       12.61
  Mobile       4.71        15.65       11.80
--------------------------------------------------------------------------------
LOSS ANALYSIS:
  Drive-Thru Balks: 46
  Mobile Reneges:   15
  Food Waste Cost:  $21.30
--------------------------------------------------------------------------------
FINANCIALS:
  Gross Revenue:    $10,050.70
  Food Costs:       $1,305.05
  Labor Cost:       $1,976.80 (7 Staff)
  Penalties:        $649.20
  NET PROFIT:       $6,119.65
--------------------------------------------------------------------------------
RESOURCE UTILIZATION:
  STATION    BUSY TIME (m)   CAPACITY    UTIL %
  URN        213.30          2           11.11
  ESPRESSO   561.80          2           29.26
  FOOD       1327.84         2           69.16
  PACKER     607.54          1           63.29
  SEATING    2541.77         10          26.48
  BUSSER     90.50           1           9.43
================================================================================

>>> RUNNING REPLICATION WITH INTERNAL SEED 30...

--- STARTING INTEGRATED SIMULATION (LANE CAP: 8) ---
[Time 154.59] ESPRESSO MACHINE MAINTENANCE STARTED (8.80 min).
[Time 163.39] ESPRESSO MACHINE ONLINE.
[Time 365.52] ESPRESSO MACHINE MAINTENANCE STARTED (8.09 min).
[Time 373.61] ESPRESSO MACHINE ONLINE.


================================================================================
                         FINAL STATISTICS -- SEED 30
================================================================================
THROUGHPUT:
  Walk-In:   328
  Drive-Thru: 415
  Mobile:    219
  TOTAL:     962
--------------------------------------------------------------------------------
WAIT TIMES (Arrival -> Food Ready/Depart) [Minutes]:
  CHANNEL     AVG        MAX         95th %ILE
  Walk-In     6.48       19.40       15.92
  Drive-Thru  6.13       18.04       14.44
  Mobile      5.10       18.32       15.12
--------------------------------------------------------------------------------
LOSS ANALYSIS:
  Drive-Thru Balks: 55
  Mobile Reneges:   24
  Food Waste Cost:  $37.90
--------------------------------------------------------------------------------
FINANCIALS:
  Gross Revenue:    $9,953.10
  Food Costs:       $1,311.80
  Labor Cost:       $1,976.80 (7 Staff)
  Penalties:        $876.50
  NET PROFIT:       $5,788.00
--------------------------------------------------------------------------------
RESOURCE UTILIZATION:
  STATION    BUSY TIME (m)   CAPACITY    UTIL %
  URN        207.27          2           10.80
  ESPRESSO   542.74          2           28.27
```

```
  FOOD       1337.79         2            69.68
  PACKER      599.58         1            62.46
  SEATING    2439.31        10            25.41
  BUSSER       90.50         1             9.43
================================================================================

>>> RUNNING REPLICATION WITH INTERNAL SEED 42...

--- STARTING INTEGRATED SIMULATION (LANE CAP: 8) ---
[Time 89.89] ESPRESSO MACHINE MAINTENANCE STARTED (2.49 min).
[Time 92.38] ESPRESSO MACHINE ONLINE.
[Time 912.69] ESPRESSO MACHINE MAINTENANCE STARTED (7.03 min).
[Time 919.71] ESPRESSO MACHINE ONLINE.


================================================================================
                       FINAL STATISTICS -- SEED 42
================================================================================
THROUGHPUT:
  Walk-In:    328
  Drive-Thru: 411
  Mobile:     219
  TOTAL:      958
--------------------------------------------------------------------------------
WAIT TIMES (Arrival -> Food Ready/Depart) [Minutes]:
  CHANNEL     AVG        MAX         95th %ILE
  Walk-In    6.75       18.94       16.03
  Drive-Thru 6.61       18.49       15.67
  Mobile     5.40       18.17       14.77
--------------------------------------------------------------------------------
LOSS ANALYSIS:
  Drive-Thru Balks: 59
  Mobile Reneges:   28
  Food Waste Cost:  $46.15
--------------------------------------------------------------------------------
FINANCIALS:
  Gross Revenue:   $9,890.20
  Food Costs:      $1,311.00
  Labor Cost:      $1,976.80 (7 Staff)
  Penalties:       $993.20
  NET PROFIT:      $5,609.20
--------------------------------------------------------------------------------
RESOURCE UTILIZATION:
  STATION    BUSY TIME (m)   CAPACITY    UTIL %
  URN         213.00         2            11.09
  ESPRESSO    531.35         2            27.67
  FOOD       1341.01         2            69.84
  PACKER      615.23         1            64.09
  SEATING    2496.66        10            26.01
  BUSSER       90.50         1             9.43
================================================================================

################################################################################
                       CROSS-REPLICATION SUMMARY (5 RUNS)
################################################################################
METRIC            MEAN          95% CI (+/-)
------------------------------------------------------------
Net Profit        $5854.99      $237.63
Throughput        964.0         5.9
Avg Wait (All)    5.99          0.35
95% Tail Wait     13.91         1.84
------------------------------------------------------------
Avg Balks/Day:   53.0
Avg Reneges/Day: 20.2
================================================================================
```

```
# Staffing
NUM_CASHIERS = 1
NUM_COOKS = 2
NUM_BARISTAS = 2
NUM_PACKERS = 1
NUM_BUSSERS = 1

# Capacities
SHELF_CAPACITY = 6
DRIVE_THRU_LANE_SIZE = 6
URN_BATCH_SIZE = 50
NUM_TABLES = 10
================================================================================
STARTING CRN SIMULATION (Same Customers, Different Internal Events)
Customer Seed: 42 | Replication Seeds: [1, 2, 5, 30, 42]
================================================================================
>>> GENERATING MASTER WORKLOAD (Seed 42)...
    Generated 1017 customers.

>>> RUNNING REPLICATION WITH INTERNAL SEED 1...

--- STARTING INTEGRATED SIMULATION (LANE CAP: 7) ---
[Time 100.09] ESPRESSO MACHINE MAINTENANCE STARTED (4.89 min).
[Time 104.97] ESPRESSO MACHINE ONLINE.
[Time 691.51] ESPRESSO MACHINE MAINTENANCE STARTED (11.20 min).
[Time 702.71] ESPRESSO MACHINE ONLINE.


================================================================================
                        FINAL STATISTICS -- SEED 1
================================================================================
THROUGHPUT:
  Walk-In:    328
  Drive-Thru: 384
  Mobile:     219
  TOTAL:      931
--------------------------------------------------------------------------------
WAIT TIMES (Arrival -> Food Ready/Depart) [Minutes]:
  CHANNEL     AVG        MAX        95th %ILE
  Walk-In     7.72       25.06      18.04
  Drive-Thru  6.91       24.91      16.04
  Mobile      6.71       23.51      16.92
--------------------------------------------------------------------------------
LOSS ANALYSIS:
  Drive-Thru Balks: 86
  Mobile Reneges:   52
  Food Waste Cost:  $81.75
--------------------------------------------------------------------------------
FINANCIALS:
  Gross Revenue:   $9,646.30
  Food Costs:      $1,316.65
  Labor Cost:      $1,976.80 (7 Staff)
  Penalties:       $1,521.10
  NET PROFIT:      $4,831.75
--------------------------------------------------------------------------------
RESOURCE UTILIZATION:
  STATION     BUSY TIME (m)   CAPACITY    UTIL %
  URN         203.04          2           10.58
  ESPRESSO    538.30          2           28.04
  FOOD        1291.02         2           67.24
  PACKER      587.45          1           61.19
  SEATING     2593.49         10          27.02
  BUSSER      90.50           1           9.43
================================================================================

>>> RUNNING REPLICATION WITH INTERNAL SEED 2...

--- STARTING INTEGRATED SIMULATION (LANE CAP: 7) ---
[Time 24.89] ESPRESSO MACHINE MAINTENANCE STARTED (2.59 min).
[Time 27.48] ESPRESSO MACHINE ONLINE.
[Time 104.64] ESPRESSO MACHINE MAINTENANCE STARTED (12.93 min).
[Time 117.57] ESPRESSO MACHINE ONLINE.


================================================================================
```

```
                        FINAL STATISTICS -- SEED 2
================================================================================
THROUGHPUT:
  Walk-In:    328
  Drive-Thru: 373
  Mobile:     219
  TOTAL:      920
--------------------------------------------------------------------------------
WAIT TIMES (Arrival -> Food Ready/Depart) [Minutes]:
  CHANNEL     AVG       MAX       95th %ILE
  Walk-In     8.39      25.28     20.19
  Drive-Thru  7.10      27.01     18.44
  Mobile      7.59      24.01     19.40
--------------------------------------------------------------------------------
LOSS ANALYSIS:
  Drive-Thru Balks: 97
  Mobile Reneges:   58
  Food Waste Cost:  $85.85
--------------------------------------------------------------------------------
FINANCIALS:
  Gross Revenue:    $9,535.30
  Food Costs:       $1,305.90
  Labor Cost:       $1,976.80 (7 Staff)
  Penalties:        $1,665.30
  NET PROFIT:       $4,587.30
--------------------------------------------------------------------------------
RESOURCE UTILIZATION:
  STATION     BUSY TIME (m)   CAPACITY   UTIL %
  URN         206.44          2          10.75
  ESPRESSO    529.47          2          27.58
  FOOD        1275.29         2          66.42
  PACKER      582.37          1          60.66
  SEATING     2791.74         10         29.08
  BUSSER      90.50           1          9.43
================================================================================

>>> RUNNING REPLICATION WITH INTERNAL SEED 5...

--- STARTING INTEGRATED SIMULATION (LANE CAP: 7) ---
[Time 53.28] ESPRESSO MACHINE MAINTENANCE STARTED (9.82 min).
[Time 63.10] ESPRESSO MACHINE ONLINE.
[Time 835.90] ESPRESSO MACHINE MAINTENANCE STARTED (10.98 min).
[Time 846.88] ESPRESSO MACHINE ONLINE.


================================================================================
                        FINAL STATISTICS -- SEED 5
================================================================================
THROUGHPUT:
  Walk-In:    328
  Drive-Thru: 402
  Mobile:     219
  TOTAL:      949
--------------------------------------------------------------------------------
WAIT TIMES (Arrival -> Food Ready/Depart) [Minutes]:
  CHANNEL     AVG       MAX       95th %ILE
  Walk-In     6.62      17.62     14.94
  Drive-Thru  6.16      19.35     13.67
  Mobile      5.53      17.72     14.13
--------------------------------------------------------------------------------
LOSS ANALYSIS:
  Drive-Thru Balks: 68
  Mobile Reneges:   29
  Food Waste Cost:  $47.45
--------------------------------------------------------------------------------
FINANCIALS:
  Gross Revenue:    $9,786.70
  Food Costs:       $1,300.70
  Labor Cost:       $1,976.80 (7 Staff)
  Penalties:        $1,117.10
  NET PROFIT:       $5,392.10
--------------------------------------------------------------------------------
RESOURCE UTILIZATION:
  STATION     BUSY TIME (m)   CAPACITY   UTIL %
```

```
  URN          214.05        2            11.15
  ESPRESSO     524.60        2            27.32
  FOOD         1306.03       2            68.02
  PACKER       600.29        1            62.53
  SEATING      2888.31       10           30.09
  BUSSER       90.50         1            9.43
================================================================================

>>> RUNNING REPLICATION WITH INTERNAL SEED 30...

--- STARTING INTEGRATED SIMULATION (LANE CAP: 7) ---
[Time 154.59] ESPRESSO MACHINE MAINTENANCE STARTED (8.80 min).
[Time 163.39] ESPRESSO MACHINE ONLINE.
[Time 365.52] ESPRESSO MACHINE MAINTENANCE STARTED (9.70 min).
[Time 375.22] ESPRESSO MACHINE ONLINE.


================================================================================
                       FINAL STATISTICS -- SEED 30
================================================================================
THROUGHPUT:
  Walk-In:    328
  Drive-Thru: 391
  Mobile:     219
  TOTAL:      938
--------------------------------------------------------------------------------
WAIT TIMES (Arrival -> Food Ready/Depart) [Minutes]:
  CHANNEL       AVG        MAX         95th %ILE
  Walk-In       6.99       20.09       16.74
  Drive-Thru    6.23       20.29       14.03
  Mobile        6.03       18.41       15.85
--------------------------------------------------------------------------------
LOSS ANALYSIS:
  Drive-Thru Balks: 79
  Mobile Reneges:   36
  Food Waste Cost:  $53.75
--------------------------------------------------------------------------------
FINANCIALS:
  Gross Revenue:   $9,711.80
  Food Costs:      $1,297.65
  Labor Cost:      $1,976.80 (7 Staff)
  Penalties:       $1,245.10
  NET PROFIT:      $5,192.25
--------------------------------------------------------------------------------
RESOURCE UTILIZATION:
  STATION      BUSY TIME (m)   CAPACITY    UTIL %
  URN          204.77        2            10.67
  ESPRESSO     528.47        2            27.52
  FOOD         1300.61       2            67.74
  PACKER       595.98        1            62.08
  SEATING      2844.45       10           29.63
  BUSSER       90.50         1            9.43
================================================================================

>>> RUNNING REPLICATION WITH INTERNAL SEED 42...

--- STARTING INTEGRATED SIMULATION (LANE CAP: 7) ---
[Time 89.89] ESPRESSO MACHINE MAINTENANCE STARTED (2.49 min).
[Time 92.38] ESPRESSO MACHINE ONLINE.
[Time 912.69] ESPRESSO MACHINE MAINTENANCE STARTED (7.15 min).
[Time 919.84] ESPRESSO MACHINE ONLINE.


================================================================================
                       FINAL STATISTICS -- SEED 42
================================================================================
THROUGHPUT:
  Walk-In:    328
  Drive-Thru: 393
  Mobile:     219
  TOTAL:      940
--------------------------------------------------------------------------------
WAIT TIMES (Arrival -> Food Ready/Depart) [Minutes]:
  CHANNEL       AVG        MAX         95th %ILE
  Walk-In       7.12       21.40       16.98
```

```
  Drive-Thru   6.38         21.77       15.96
  Mobile       6.25         20.68       16.06
-------------------------------------------------------------------------------
LOSS ANALYSIS:
  Drive-Thru Balks: 77
  Mobile Reneges:   39
  Food Waste Cost:  $65.60
-------------------------------------------------------------------------------
FINANCIALS:
  Gross Revenue:    $9,713.00
  Food Costs:       $1,308.65
  Labor Cost:       $1,976.80 (7 Staff)
  Penalties:        $1,325.40
  NET PROFIT:       $5,102.15
-------------------------------------------------------------------------------
RESOURCE UTILIZATION:
  STATION     BUSY TIME (m)   CAPACITY   UTIL %
  URN         214.94          2          11.19
  ESPRESSO    544.87          2          28.38
  FOOD        1315.95         2          68.54
  PACKER      590.78          1          61.54
  SEATING     2497.17         10         26.01
  BUSSER      90.50           1          9.43
===============================================================================

###############################################################################
                    CROSS-REPLICATION SUMMARY (5 RUNS)
###############################################################################
METRIC              MEAN            95% CI (+/-)
---------------------------------------------------------------
Net Profit          $5021.11        $391.38
Throughput          935.6           13.4
Avg Wait (All)      6.81            0.75
95% Tail Wait       16.79           2.55
---------------------------------------------------------------
Avg Balks/Day:   81.4
Avg Reneges/Day: 42.8
===============================================================================
```

```
# --- 1. CONFIGURATION ---
SIM_DURATION = 16 * 60     # 960 Minutes (e.g., 7:00 AM to 11:00 PM)
CLOSE_TIME = 16 * 60
MORNING_TIME = 4.0 * 60     # 11:00 AM
LUNCH_TIME = 8.0 * 60       # 3:00 PM

# Staffing
NUM_CASHIERS = 1
NUM_COOKS = 3
NUM_BARISTAS = 2
NUM_PACKERS = 2
NUM_BUSSERS = 1

# Capacities
SHELF_CAPACITY = 10
DRIVE_THRU_LANE_SIZE = 10
URN_BATCH_SIZE = 50
NUM_TABLES = 10


================================================================================
STARTING CRN SIMULATION (Same Customers, Different Internal Events)
Customer Seed: 42 | Replication Seeds: [1, 2, 5, 30, 42]
================================================================================
>>> GENERATING MASTER WORKLOAD (Seed 42)...
    Generated 1017 customers.

>>> RUNNING REPLICATION WITH INTERNAL SEED 1...

--- STARTING INTEGRATED SIMULATION (LANE CAP: 10) ---
[Time 100.09] ESPRESSO MACHINE MAINTENANCE STARTED (4.89 min).
[Time 104.97] ESPRESSO MACHINE ONLINE.
[Time 691.51] ESPRESSO MACHINE MAINTENANCE STARTED (4.69 min).
[Time 696.20] ESPRESSO MACHINE ONLINE.


================================================================================
                         FINAL STATISTICS -- SEED 1
================================================================================
THROUGHPUT:
  Walk-In:   328
  Drive-Thru: 460
  Mobile:    219
  TOTAL:     1007
--------------------------------------------------------------------------------
WAIT TIMES (Arrival -> Food Ready/Depart) [Minutes]:
  CHANNEL     AVG        MAX        95th %ILE
  Walk-In    5.09       13.28      10.74
  Drive-Thru 5.49       15.53      11.22
  Mobile     4.22       12.32      9.26
--------------------------------------------------------------------------------
LOSS ANALYSIS:
  Drive-Thru Balks: 10
  Mobile Reneges:   4
  Food Waste Cost:  $7.25
--------------------------------------------------------------------------------
FINANCIALS:
  Gross Revenue:   $10,428.40
  Food Costs:      $1,340.20
  Labor Cost:      $2,824.00 (10 Staff)
  Penalties:       $174.40
  NET PROFIT:      $6,089.80
--------------------------------------------------------------------------------
RESOURCE UTILIZATION:
  STATION    BUSY TIME (m)   CAPACITY   UTIL %
  URN        224.11          2          11.67
  ESPRESSO   583.79          2          30.41
  FOOD       1390.08         3          48.27
  PACKER     1142.28         2          59.49
  SEATING    2397.75         10         24.98
```

```
  BUSSER       90.50        1          9.43
================================================================================

>>> RUNNING REPLICATION WITH INTERNAL SEED 2...

--- STARTING INTEGRATED SIMULATION (LANE CAP: 10) ---
[Time 24.89] ESPRESSO MACHINE MAINTENANCE STARTED (7.74 min).
[Time 32.63] ESPRESSO MACHINE ONLINE.
[Time 104.64] ESPRESSO MACHINE MAINTENANCE STARTED (14.41 min).
[Time 119.04] ESPRESSO MACHINE ONLINE.

================================================================================
                         FINAL STATISTICS -- SEED 2
================================================================================
THROUGHPUT:
  Walk-In:    328
  Drive-Thru: 457
  Mobile:     219
  TOTAL:      1004
--------------------------------------------------------------------------------
WAIT TIMES (Arrival -> Food Ready/Depart) [Minutes]:
  CHANNEL     AVG        MAX        95th %ILE
  Walk-In     4.90       12.77      9.54
  Drive-Thru  5.36       14.04      10.30
  Mobile      3.98       10.52      8.46
--------------------------------------------------------------------------------
LOSS ANALYSIS:
  Drive-Thru Balks: 13
  Mobile Reneges:   0
  Food Waste Cost:  $0.00
--------------------------------------------------------------------------------
FINANCIALS:
  Gross Revenue:    $10,378.80
  Food Costs:       $1,328.25
  Labor Cost:       $2,824.00 (10 Staff)
  Penalties:        $159.60
  NET PROFIT:       $6,066.95
--------------------------------------------------------------------------------
RESOURCE UTILIZATION:
  STATION     BUSY TIME (m)   CAPACITY   UTIL %
  URN         226.48          2          11.80
  ESPRESSO    574.92          2          29.94
  FOOD        1395.39         3          48.45
  PACKER      1135.84         2          59.16
  SEATING     2593.82         10         27.02
  BUSSER      90.50           1          9.43
================================================================================

>>> RUNNING REPLICATION WITH INTERNAL SEED 5...

--- STARTING INTEGRATED SIMULATION (LANE CAP: 10) ---
[Time 53.28] ESPRESSO MACHINE MAINTENANCE STARTED (10.83 min).
[Time 64.11] ESPRESSO MACHINE ONLINE.
[Time 835.90] ESPRESSO MACHINE MAINTENANCE STARTED (6.98 min).
[Time 842.89] ESPRESSO MACHINE ONLINE.

================================================================================
                         FINAL STATISTICS -- SEED 5
================================================================================
THROUGHPUT:
  Walk-In:    328
  Drive-Thru: 460
  Mobile:     219
  TOTAL:      1007
--------------------------------------------------------------------------------
WAIT TIMES (Arrival -> Food Ready/Depart) [Minutes]:
  CHANNEL     AVG        MAX        95th %ILE
  Walk-In     4.96       12.99      10.59
  Drive-Thru  5.40       14.14      10.74
  Mobile      4.26       11.55      9.46
--------------------------------------------------------------------------------
LOSS ANALYSIS:
  Drive-Thru Balks: 10
```

```
   Mobile Reneges:   2
   Food Waste Cost: $3.45
--------------------------------------------------------------------------------
FINANCIALS:
   Gross Revenue:   $10,436.60
   Food Costs:      $1,337.75
   Labor Cost:      $2,824.00 (10 Staff)
   Penalties:       $130.90
   NET PROFIT:      $6,143.95
--------------------------------------------------------------------------------
RESOURCE UTILIZATION:
   STATION    BUSY TIME (m)   CAPACITY    UTIL %
   URN        210.75          2           10.98
   ESPRESSO   575.58          2           29.98
   FOOD       1389.32         3           48.24
   PACKER     1139.74         2           59.36
   SEATING    2807.78         10          29.25
   BUSSER     90.50           1           9.43
================================================================================

>>> RUNNING REPLICATION WITH INTERNAL SEED 30...

--- STARTING INTEGRATED SIMULATION (LANE CAP: 10) ---
[Time 154.59] ESPRESSO MACHINE MAINTENANCE STARTED (12.97 min).
[Time 167.57] ESPRESSO MACHINE ONLINE.
[Time 365.52] ESPRESSO MACHINE MAINTENANCE STARTED (4.25 min).
[Time 369.77] ESPRESSO MACHINE ONLINE.

================================================================================
                        FINAL STATISTICS -- SEED 30
================================================================================
THROUGHPUT:
   Walk-In:   328
   Drive-Thru: 461
   Mobile:    219
   TOTAL:     1008
--------------------------------------------------------------------------------
WAIT TIMES (Arrival -> Food Ready/Depart) [Minutes]:
   CHANNEL    AVG         MAX         95th %ILE
   Walk-In    4.84        15.10       10.39
   Drive-Thru 5.43        17.68       10.92
   Mobile     4.07        13.69       9.14
--------------------------------------------------------------------------------
LOSS ANALYSIS:
   Drive-Thru Balks: 9
   Mobile Reneges:   5
   Food Waste Cost: $8.15
--------------------------------------------------------------------------------
FINANCIALS:
   Gross Revenue:   $10,440.30
   Food Costs:      $1,343.10
   Labor Cost:      $2,824.00 (10 Staff)
   Penalties:       $169.70
   NET PROFIT:      $6,103.50
--------------------------------------------------------------------------------
RESOURCE UTILIZATION:
   STATION    BUSY TIME (m)   CAPACITY    UTIL %
   URN        219.30          2           11.42
   ESPRESSO   571.36          2           29.76
   FOOD       1392.86         3           48.36
   PACKER     1134.59         2           59.09
   SEATING    2740.08         10          28.54
   BUSSER     90.50           1           9.43
================================================================================

>>> RUNNING REPLICATION WITH INTERNAL SEED 42...

--- STARTING INTEGRATED SIMULATION (LANE CAP: 10) ---
[Time 89.89] ESPRESSO MACHINE MAINTENANCE STARTED (3.65 min).
[Time 93.54] ESPRESSO MACHINE ONLINE.
[Time 912.69] ESPRESSO MACHINE MAINTENANCE STARTED (5.33 min).
[Time 918.02] ESPRESSO MACHINE ONLINE.
```

```
================================================================================
                        FINAL STATISTICS -- SEED 42
================================================================================
THROUGHPUT:
  Walk-In:    328
  Drive-Thru: 456
  Mobile:     219
  TOTAL:      1003
--------------------------------------------------------------------------------
WAIT TIMES (Arrival -> Food Ready/Depart) [Minutes]:
  CHANNEL      AVG        MAX       95th %ILE
  Walk-In     5.07       14.01     10.77
  Drive-Thru  5.54       13.41     10.99
  Mobile      4.28       11.86     9.65
--------------------------------------------------------------------------------
LOSS ANALYSIS:
  Drive-Thru Balks: 14
  Mobile Reneges:   3
  Food Waste Cost:  $3.60
--------------------------------------------------------------------------------
FINANCIALS:
  Gross Revenue:    $10,372.90
  Food Costs:       $1,329.80
  Labor Cost:       $2,824.00 (10 Staff)
  Penalties:        $198.10
  NET PROFIT:       $6,021.00
--------------------------------------------------------------------------------
RESOURCE UTILIZATION:
  STATION     BUSY TIME (m)   CAPACITY   UTIL %
  URN         219.42          2          11.43
  ESPRESSO    570.49          2          29.71
  FOOD        1381.91         3          47.98
  PACKER      1150.41         2          59.92
  SEATING     2703.78         10         28.16
  BUSSER      90.50           1          9.43
================================================================================

################################################################################
                     CROSS-REPLICATION SUMMARY (5 RUNS)
################################################################################
METRIC            MEAN          95% CI (+/-)
------------------------------------------------------------
Net Profit        $6085.04      $56.42
Throughput        1005.8        2.7
Avg Wait (All)    5.01          0.11
95% Tail Wait     10.38         0.39
------------------------------------------------------------
Avg Balks/Day:   11.2
Avg Reneges/Day: 2.8
================================================================================
```

# Customers for a Slow Day

```
Drive thru length
Shelf room
Staffing Changes

# --- 1. CONFIGURATION ---
SIM_DURATION = 16 * 60     # 960 Minutes (e.g., 7:00 AM to 11:00 PM)
CLOSE_TIME = 16 * 60
MORNING_TIME = 4.0 * 60    # 11:00 AM
LUNCH_TIME = 8.0 * 60      # 3:00 PM


# Staffing
NUM_CASHIERS = 1
NUM_COOKS = 3
NUM_BARISTAS = 2
NUM_PACKERS = 1
NUM_BUSSERS = 1

# Capacities
SHELF_CAPACITY = 6
DRIVE_THRU_LANE_SIZE = 6
URN_BATCH_SIZE = 50
NUM_TABLES = 10


================================================================================
STARTING CRN SIMULATION (Same Customers, Different Internal Events)
Customer Seed: 42 | Replication Seeds: [1, 2, 5, 30, 42]
================================================================================
>>> GENERATING MASTER WORKLOAD (Seed 42)...
    Generated 738 customers.

>>> RUNNING REPLICATION WITH INTERNAL SEED 1...

--- STARTING INTEGRATED SIMULATION (LANE CAP: 6) ---
[Time 100.09] ESPRESSO MACHINE MAINTENANCE STARTED (7.55 min).
[Time 107.63] ESPRESSO MACHINE ONLINE.
[Time 691.51] ESPRESSO MACHINE MAINTENANCE STARTED (13.24 min).
[Time 704.75] ESPRESSO MACHINE ONLINE.

================================================================================
                        FINAL STATISTICS -- SEED 1
================================================================================
THROUGHPUT:
   Walk-In:    246
   Drive-Thru: 297
   Mobile:     180
   TOTAL:      723
--------------------------------------------------------------------------------
WAIT TIMES (Arrival -> Food Ready/Depart) [Minutes]:
   CHANNEL      AVG        MAX        95th %ILE
   Walk-In      5.17       15.67      12.80
   Drive-Thru   4.80       16.09      11.21
   Mobile       4.72       14.46      10.82
--------------------------------------------------------------------------------
LOSS ANALYSIS:
   Drive-Thru Balks: 15
   Mobile Reneges:   10
   Food Waste Cost:  $19.45
--------------------------------------------------------------------------------
FINANCIALS:
   Gross Revenue:    $7,395.20
   Food Costs:       $962.00
   Labor Cost:       $2,259.20 (8 Staff)
   Penalties:        $309.30
   NET PROFIT:       $3,864.70
--------------------------------------------------------------------------------
RESOURCE UTILIZATION:
   STATION     BUSY TIME (m)   CAPACITY    UTIL %
   URN         159.33          2           8.30
   ESPRESSO    410.13          2           21.36
```

```
   FOOD         965.84         3            33.54
   PACKER       547.96         1            57.08
   SEATING      1886.61        10           19.65
   BUSSER       67.50          1            7.03
================================================================================

>>> RUNNING REPLICATION WITH INTERNAL SEED 2...

--- STARTING INTEGRATED SIMULATION (LANE CAP: 6) ---
[Time 24.89] ESPRESSO MACHINE MAINTENANCE STARTED (11.94 min).
[Time 36.83] ESPRESSO MACHINE ONLINE.
[Time 104.64] ESPRESSO MACHINE MAINTENANCE STARTED (8.36 min).
[Time 113.00] ESPRESSO MACHINE ONLINE.


================================================================================
                          FINAL STATISTICS -- SEED 2
================================================================================
THROUGHPUT:
  Walk-In:    246
  Drive-Thru: 302
  Mobile:     180
  TOTAL:      728
--------------------------------------------------------------------------------
WAIT TIMES (Arrival -> Food Ready/Depart) [Minutes]:
  CHANNEL      AVG         MAX          95th %ILE
  Walk-In     5.15        13.77        12.47
  Drive-Thru  4.69        14.25        11.04
  Mobile      4.46        12.30        10.23
--------------------------------------------------------------------------------
LOSS ANALYSIS:
  Drive-Thru Balks: 10
  Mobile Reneges:   8
  Food Waste Cost:  $14.90
--------------------------------------------------------------------------------
FINANCIALS:
  Gross Revenue:   $7,450.30
  Food Costs:      $965.90
  Labor Cost:      $2,259.20 (8 Staff)
  Penalties:       $219.20
  NET PROFIT:      $4,006.00
--------------------------------------------------------------------------------
RESOURCE UTILIZATION:
  STATION      BUSY TIME (m)    CAPACITY    UTIL %
  URN          160.54           2           8.36
  ESPRESSO     424.86           2           22.13
  FOOD         961.57           3           33.39
  PACKER       551.52           1           57.45
  SEATING      2035.11          10          21.20
  BUSSER       67.50            1           7.03
================================================================================

>>> RUNNING REPLICATION WITH INTERNAL SEED 5...

--- STARTING INTEGRATED SIMULATION (LANE CAP: 6) ---
[Time 53.28] ESPRESSO MACHINE MAINTENANCE STARTED (14.50 min).
[Time 67.77] ESPRESSO MACHINE ONLINE.
[Time 835.90] ESPRESSO MACHINE MAINTENANCE STARTED (5.01 min).
[Time 840.91] ESPRESSO MACHINE ONLINE.


================================================================================
                          FINAL STATISTICS -- SEED 5
================================================================================
THROUGHPUT:
  Walk-In:    246
  Drive-Thru: 304
  Mobile:     180
  TOTAL:      730
--------------------------------------------------------------------------------
WAIT TIMES (Arrival -> Food Ready/Depart) [Minutes]:
  CHANNEL      AVG         MAX          95th %ILE
  Walk-In     4.92        17.91        11.89
  Drive-Thru  4.72        15.63        10.45
  Mobile      4.41        16.24        10.60
```

```
--------------------------------------------------------------------------------
LOSS ANALYSIS:
  Drive-Thru Balks: 8
  Mobile Reneges:   6
  Food Waste Cost:  $10.10
--------------------------------------------------------------------------------
FINANCIALS:
  Gross Revenue:    $7,458.60
  Food Costs:       $962.05
  Labor Cost:       $2,259.20 (8 Staff)
  Penalties:        $181.30
  NET PROFIT:       $4,056.05
--------------------------------------------------------------------------------
RESOURCE UTILIZATION:
  STATION    BUSY TIME (m)   CAPACITY   UTIL %
  URN        160.20          2          8.34
  ESPRESSO   422.25          2          21.99
  FOOD       975.01          3          33.85
  PACKER     539.32          1          56.18
  SEATING    2131.84         10         22.21
  BUSSER     67.50           1          7.03
================================================================================

>>> RUNNING REPLICATION WITH INTERNAL SEED 30...

--- STARTING INTEGRATED SIMULATION (LANE CAP: 6) ---
[Time 154.59] ESPRESSO MACHINE MAINTENANCE STARTED (7.83 min).
[Time 162.43] ESPRESSO MACHINE ONLINE.
[Time 365.52] ESPRESSO MACHINE MAINTENANCE STARTED (11.26 min).
[Time 376.78] ESPRESSO MACHINE ONLINE.

================================================================================
                        FINAL STATISTICS -- SEED 30
================================================================================
THROUGHPUT:
  Walk-In:   246
  Drive-Thru: 300
  Mobile:    180
  TOTAL:     726
--------------------------------------------------------------------------------
WAIT TIMES (Arrival -> Food Ready/Depart) [Minutes]:
  CHANNEL    AVG        MAX        95th %ILE
  Walk-In    5.13       15.47      12.59
  Drive-Thru 4.71       13.62      11.56
  Mobile     4.50       12.98      11.26
--------------------------------------------------------------------------------
LOSS ANALYSIS:
  Drive-Thru Balks: 12
  Mobile Reneges:   10
  Food Waste Cost:  $19.40
--------------------------------------------------------------------------------
FINANCIALS:
  Gross Revenue:    $7,429.00
  Food Costs:       $968.25
  Labor Cost:       $2,259.20 (8 Staff)
  Penalties:        $276.30
  NET PROFIT:       $3,925.25
--------------------------------------------------------------------------------
RESOURCE UTILIZATION:
  STATION    BUSY TIME (m)   CAPACITY   UTIL %
  URN        164.45          2          8.57
  ESPRESSO   405.22          2          21.11
  FOOD       967.10          3          33.58
  PACKER     550.30          1          57.32
  SEATING    2025.42         10         21.10
  BUSSER     67.50           1          7.03
================================================================================

>>> RUNNING REPLICATION WITH INTERNAL SEED 42...

--- STARTING INTEGRATED SIMULATION (LANE CAP: 6) ---
[Time 89.89] ESPRESSO MACHINE MAINTENANCE STARTED (5.82 min).
[Time 95.71] ESPRESSO MACHINE ONLINE.
```

```
[Time 912.69] ESPRESSO MACHINE MAINTENANCE STARTED (4.21 min).
[Time 916.89] ESPRESSO MACHINE ONLINE.


================================================================================
                          FINAL STATISTICS -- SEED 42
================================================================================
THROUGHPUT:
  Walk-In:   246
  Drive-Thru: 301
  Mobile:    180
  TOTAL:     727
--------------------------------------------------------------------------------
WAIT TIMES (Arrival -> Food Ready/Depart) [Minutes]:
  CHANNEL     AVG        MAX       95th %ILE
  Walk-In    4.99       13.33      11.11
  Drive-Thru 4.80       13.33      10.42
  Mobile     4.42       11.53      9.74
--------------------------------------------------------------------------------
LOSS ANALYSIS:
  Drive-Thru Balks: 11
  Mobile Reneges:   3
  Food Waste Cost:  $7.15
--------------------------------------------------------------------------------
FINANCIALS:
  Gross Revenue:    $7,451.10
  Food Costs:       $958.65
  Labor Cost:       $2,259.20 (8 Staff)
  Penalties:        $162.60
  NET PROFIT:       $4,070.65
--------------------------------------------------------------------------------
RESOURCE UTILIZATION:
  STATION    BUSY TIME (m)   CAPACITY    UTIL %
  URN        156.28          2           8.14
  ESPRESSO   411.88          2           21.45
  FOOD       970.43          3           33.70
  PACKER     550.59          1           57.35
  SEATING    1783.07         10          18.57
  BUSSER     67.50           1           7.03
================================================================================


################################################################################
                       CROSS-REPLICATION SUMMARY (5 RUNS)
################################################################################
METRIC            MEAN           95% CI (+/-)
----------------------------------------------------------------

Net Profit        $3984.53       $109.05
Throughput        726.8          3.2
Avg Wait (All)    4.80           0.09
95% Tail Wait     11.17          0.62
----------------------------------------------------------------
Avg Balks/Day:   11.2
Avg Reneges/Day: 7.4
================================================================================
```

```
SIM_DURATION = 16 * 60     # 960 Minutes (e.g., 7:00 AM to 11:00 PM)
CLOSE_TIME = 16 * 60
MORNING_TIME = 4.0 * 60     # 11:00 AM
LUNCH_TIME = 8.0 * 60       # 3:00 PM


# Staffing
NUM_CASHIERS = 1
NUM_COOKS = 3
NUM_BARISTAS = 2
NUM_PACKERS = 1
NUM_BUSSERS = 1


# Capacities
SHELF_CAPACITY = 10
DRIVE_THRU_LANE_SIZE = 10
URN_BATCH_SIZE = 50
NUM_TABLES = 10


================================================================================
STARTING CRN SIMULATION (Same Customers, Different Internal Events)
Customer Seed: 42 | Replication Seeds: [1, 2, 5, 30, 42]
================================================================================
>>> GENERATING MASTER WORKLOAD (Seed 42)...
    Generated 738 customers.

>>> RUNNING REPLICATION WITH INTERNAL SEED 1...

--- STARTING INTEGRATED SIMULATION (LANE CAP: 8) ---
[Time 100.09] ESPRESSO MACHINE MAINTENANCE STARTED (7.55 min).
[Time 107.63] ESPRESSO MACHINE ONLINE.
[Time 691.51] ESPRESSO MACHINE MAINTENANCE STARTED (6.04 min).
[Time 697.55] ESPRESSO MACHINE ONLINE.

================================================================================
                        FINAL STATISTICS -- SEED 1
================================================================================
THROUGHPUT:
  Walk-In:    246
  Drive-Thru: 311
  Mobile:     180
  TOTAL:      737
--------------------------------------------------------------------------------
WAIT TIMES (Arrival -> Food Ready/Depart) [Minutes]:
  CHANNEL     AVG       MAX        95th %ILE
  Walk-In     4.69      12.93      10.32
  Drive-Thru  4.65      12.57      9.94
  Mobile      4.03      11.37      8.93
--------------------------------------------------------------------------------
LOSS ANALYSIS:
  Drive-Thru Balks: 1
  Mobile Reneges:   1
  Food Waste Cost:  $1.90
--------------------------------------------------------------------------------
FINANCIALS:
  Gross Revenue:    $7,551.60
  Food Costs:       $965.75
  Labor Cost:       $2,259.20 (8 Staff)
  Penalties:        $25.30
  NET PROFIT:       $4,301.35
--------------------------------------------------------------------------------
RESOURCE UTILIZATION:
  STATION     BUSY TIME (m)   CAPACITY    UTIL %
  URN         161.21          2           8.40
  ESPRESSO    419.15          2           21.83
  FOOD        985.47          3           34.22
  PACKER      536.46          1           55.88
  SEATING     1867.46         10          19.45
  BUSSER      67.50           1           7.03
================================================================================

>>> RUNNING REPLICATION WITH INTERNAL SEED 2...

--- STARTING INTEGRATED SIMULATION (LANE CAP: 8) ---
```

```
[Time 24.89] ESPRESSO MACHINE MAINTENANCE STARTED (11.94 min).
[Time 36.83] ESPRESSO MACHINE ONLINE.
[Time 104.64] ESPRESSO MACHINE MAINTENANCE STARTED (8.36 min).
[Time 113.00] ESPRESSO MACHINE ONLINE.


================================================================================
                        FINAL STATISTICS -- SEED 2
================================================================================
THROUGHPUT:
  Walk-In:    246
  Drive-Thru: 310
  Mobile:     180
  TOTAL:      736
--------------------------------------------------------------------------------
WAIT TIMES (Arrival -> Food Ready/Depart) [Minutes]:
  CHANNEL      AVG         MAX         95th %ILE
  Walk-In     4.88        14.11       11.40
  Drive-Thru  4.60        12.74       10.39
  Mobile      3.97        11.09       9.70
--------------------------------------------------------------------------------
LOSS ANALYSIS:
  Drive-Thru Balks: 2
  Mobile Reneges:   0
  Food Waste Cost:  $0.00
--------------------------------------------------------------------------------
FINANCIALS:
  Gross Revenue:    $7,542.10
  Food Costs:       $962.70
  Labor Cost:       $2,259.20 (8 Staff)
  Penalties:        $17.00
  NET PROFIT:       $4,303.20
--------------------------------------------------------------------------------
RESOURCE UTILIZATION:
  STATION      BUSY TIME (m)   CAPACITY    UTIL %
  URN          167.02          2           8.70
  ESPRESSO     418.00          2           21.77
  FOOD         984.63          3           34.19
  PACKER       526.95          1           54.89
  SEATING      2243.82         10          23.37
  BUSSER       67.50           1           7.03
================================================================================

>>> RUNNING REPLICATION WITH INTERNAL SEED 5...

--- STARTING INTEGRATED SIMULATION (LANE CAP: 8) ---
[Time 53.28] ESPRESSO MACHINE MAINTENANCE STARTED (14.50 min).
[Time 67.77] ESPRESSO MACHINE ONLINE.
[Time 835.90] ESPRESSO MACHINE MAINTENANCE STARTED (10.86 min).
[Time 846.76] ESPRESSO MACHINE ONLINE.


================================================================================
                        FINAL STATISTICS -- SEED 5
================================================================================
THROUGHPUT:
  Walk-In:    246
  Drive-Thru: 311
  Mobile:     180
  TOTAL:      737
--------------------------------------------------------------------------------
WAIT TIMES (Arrival -> Food Ready/Depart) [Minutes]:
  CHANNEL      AVG         MAX         95th %ILE
  Walk-In     4.70        17.61       11.18
  Drive-Thru  4.63        15.26       10.55
  Mobile      3.88        16.22       9.34
--------------------------------------------------------------------------------
LOSS ANALYSIS:
  Drive-Thru Balks: 1
  Mobile Reneges:   6
  Food Waste Cost:  $10.25
--------------------------------------------------------------------------------
FINANCIALS:
  Gross Revenue:    $7,551.60
  Food Costs:       $974.10
```

```
  Labor Cost:     $2,259.20 (8 Staff)
  Penalties:      $87.50
  NET PROFIT:     $4,230.80
-------------------------------------------------------------------------------
RESOURCE UTILIZATION:
  STATION    BUSY TIME (m)   CAPACITY    UTIL %
  URN        170.46          2           8.88
  ESPRESSO   418.71          2           21.81
  FOOD       991.21          3           34.42
  PACKER     521.86          1           54.36
  SEATING    2101.86         10          21.89
  BUSSER     67.50           1           7.03
===============================================================================

>>> RUNNING REPLICATION WITH INTERNAL SEED 30...

--- STARTING INTEGRATED SIMULATION (LANE CAP: 8) ---
[Time 154.59] ESPRESSO MACHINE MAINTENANCE STARTED (7.83 min).
[Time 162.43] ESPRESSO MACHINE ONLINE.
[Time 365.52] ESPRESSO MACHINE MAINTENANCE STARTED (5.33 min).
[Time 370.85] ESPRESSO MACHINE ONLINE.


===============================================================================
                       FINAL STATISTICS -- SEED 30
===============================================================================
THROUGHPUT:
  Walk-In:    246
  Drive-Thru: 308
  Mobile:     180
  TOTAL:      734
-------------------------------------------------------------------------------
WAIT TIMES (Arrival -> Food Ready/Depart) [Minutes]:
  CHANNEL      AVG        MAX        95th %ILE
  Walk-In      5.33       16.63      13.49
  Drive-Thru   4.89       16.79      12.58
  Mobile       4.38       14.84      11.36
-------------------------------------------------------------------------------
LOSS ANALYSIS:
  Drive-Thru Balks: 4
  Mobile Reneges:   12
  Food Waste Cost:  $21.60
-------------------------------------------------------------------------------
FINANCIALS:
  Gross Revenue:  $7,528.50
  Food Costs:     $982.90
  Labor Cost:     $2,259.20 (8 Staff)
  Penalties:      $197.40
  NET PROFIT:     $4,089.00
-------------------------------------------------------------------------------
RESOURCE UTILIZATION:
  STATION    BUSY TIME (m)   CAPACITY    UTIL %
  URN        165.01          2           8.59
  ESPRESSO   406.39          2           21.17
  FOOD       981.22          3           34.07
  PACKER     541.69          1           56.43
  SEATING    1920.68         10          20.01
  BUSSER     67.50           1           7.03
===============================================================================

>>> RUNNING REPLICATION WITH INTERNAL SEED 42...

--- STARTING INTEGRATED SIMULATION (LANE CAP: 8) ---
[Time 89.89] ESPRESSO MACHINE MAINTENANCE STARTED (5.82 min).
[Time 95.71] ESPRESSO MACHINE ONLINE.
[Time 912.69] ESPRESSO MACHINE MAINTENANCE STARTED (7.62 min).
[Time 920.31] ESPRESSO MACHINE ONLINE.

===============================================================================
                       FINAL STATISTICS -- SEED 42
===============================================================================
THROUGHPUT:
  Walk-In:    246
  Drive-Thru: 311
```

```
  Mobile:      180
  TOTAL:       737
--------------------------------------------------------------------------------
WAIT TIMES (Arrival -> Food Ready/Depart) [Minutes]:
  CHANNEL     AVG        MAX        95th %ILE
  Walk-In     4.88       13.59      11.33
  Drive-Thru  4.77       12.71      10.38
  Mobile      4.04       11.20      9.76
--------------------------------------------------------------------------------
LOSS ANALYSIS:
  Drive-Thru Balks: 1
  Mobile Reneges:   2
  Food Waste Cost: $5.60
--------------------------------------------------------------------------------
FINANCIALS:
  Gross Revenue:    $7,557.60
  Food Costs:       $970.25
  Labor Cost:       $2,259.20 (8 Staff)
  Penalties:        $44.80
  NET PROFIT:       $4,283.35
--------------------------------------------------------------------------------
RESOURCE UTILIZATION:
  STATION     BUSY TIME (m)   CAPACITY    UTIL %
  URN         160.79          2           8.37
  ESPRESSO    430.87          2           22.44
  FOOD        987.87          3           34.30
  PACKER      538.51          1           56.10
  SEATING     2068.78         10          21.55
  BUSSER      67.50           1           7.03
================================================================================

################################################################################
                     CROSS-REPLICATION SUMMARY (5 RUNS)
################################################################################
METRIC              MEAN           95% CI (+/-)
-------------------------------------------------------------
Net Profit          $4241.54       $111.92
Throughput          736.2          1.6
Avg Wait (All)      4.61           0.22
95% Tail Wait       10.90          1.19
-------------------------------------------------------------
Avg Balks/Day:   1.8
Avg Reneges/Day: 4.2
================================================================================
```

```
# Staffing
NUM_CASHIERS = 1
NUM_COOKS = 2
NUM_BARISTAS = 2
NUM_PACKERS = 1
NUM_BUSSERS = 1

# Capacities
SHELF_CAPACITY = 10
DRIVE_THRU_LANE_SIZE = 10
URN_BATCH_SIZE = 50
NUM_TABLES = 10


================================================================================
STARTING CRN SIMULATION (Same Customers, Different Internal Events)
Customer Seed: 42 | Replication Seeds: [1, 2, 5, 30, 42]
================================================================================
>>> GENERATING MASTER WORKLOAD (Seed 42)...
    Generated 738 customers.

>>> RUNNING REPLICATION WITH INTERNAL SEED 1...

--- STARTING INTEGRATED SIMULATION (LANE CAP: 8) ---
[Time 100.09] ESPRESSO MACHINE MAINTENANCE STARTED (7.55 min).
[Time 107.63] ESPRESSO MACHINE ONLINE.
[Time 691.51] ESPRESSO MACHINE MAINTENANCE STARTED (4.35 min).
[Time 695.86] ESPRESSO MACHINE ONLINE.

================================================================================
                          FINAL STATISTICS -- SEED 1
================================================================================
THROUGHPUT:
  Walk-In:   246
  Drive-Thru: 309
  Mobile:    180
  TOTAL:     735
--------------------------------------------------------------------------------
WAIT TIMES (Arrival -> Food Ready/Depart) [Minutes]:
  CHANNEL     AVG        MAX        95th %ILE
  Walk-In     5.08       14.90      11.96
  Drive-Thru  5.01       14.63      10.78
  Mobile      4.25       13.08      10.09
--------------------------------------------------------------------------------
LOSS ANALYSIS:
  Drive-Thru Balks: 3
  Mobile Reneges:   5
  Food Waste Cost:  $11.75
--------------------------------------------------------------------------------
FINANCIALS:
  Gross Revenue:   $7,544.30
  Food Costs:      $975.10
  Labor Cost:      $1,976.80 (7 Staff)
  Penalties:       $100.70
  NET PROFIT:      $4,491.70
--------------------------------------------------------------------------------
RESOURCE UTILIZATION:
  STATION     BUSY TIME (m)   CAPACITY    UTIL %
  URN         167.49          2           8.72
  ESPRESSO    408.33          2           21.27
  FOOD        999.92          2           52.08
  PACKER      526.32          1           54.83
  SEATING     1848.99         10          19.26
  BUSSER      67.50           1           7.03
================================================================================

>>> RUNNING REPLICATION WITH INTERNAL SEED 2...

--- STARTING INTEGRATED SIMULATION (LANE CAP: 8) ---
[Time 24.89] ESPRESSO MACHINE MAINTENANCE STARTED (11.94 min).
[Time 36.83] ESPRESSO MACHINE ONLINE.
[Time 104.64] ESPRESSO MACHINE MAINTENANCE STARTED (8.36 min).
[Time 113.00] ESPRESSO MACHINE ONLINE.
```

```
================================================================================
                         FINAL STATISTICS -- SEED 2
================================================================================
THROUGHPUT:
  Walk-In:   246
  Drive-Thru: 310
  Mobile:    180
  TOTAL:     736
--------------------------------------------------------------------------------
WAIT TIMES (Arrival -> Food Ready/Depart) [Minutes]:
  CHANNEL     AVG        MAX        95th %ILE
  Walk-In    5.12       14.85      11.55
  Drive-Thru 5.01       14.52      10.31
  Mobile     4.28       12.81      9.46
--------------------------------------------------------------------------------
LOSS ANALYSIS:
  Drive-Thru Balks: 2
  Mobile Reneges:   3
  Food Waste Cost:  $7.80
--------------------------------------------------------------------------------
FINANCIALS:
  Gross Revenue:    $7,508.00
  Food Costs:       $965.85
  Labor Cost:       $1,976.80 (7 Staff)
  Penalties:        $104.90
  NET PROFIT:       $4,460.45
--------------------------------------------------------------------------------
RESOURCE UTILIZATION:
  STATION     BUSY TIME (m)   CAPACITY    UTIL %
  URN         159.31          2           8.30
  ESPRESSO    419.85          2           21.87
  FOOD        993.08          2           51.72
  PACKER      523.30          1           54.51
  SEATING     2009.01         10          20.93
  BUSSER      67.50           1           7.03
================================================================================

>>> RUNNING REPLICATION WITH INTERNAL SEED 5...

--- STARTING INTEGRATED SIMULATION (LANE CAP: 8) ---
[Time 53.28] ESPRESSO MACHINE MAINTENANCE STARTED (7.44 min).
[Time 60.72] ESPRESSO MACHINE ONLINE.
[Time 835.90] ESPRESSO MACHINE MAINTENANCE STARTED (5.72 min).
[Time 841.62] ESPRESSO MACHINE ONLINE.


================================================================================
                         FINAL STATISTICS -- SEED 5
================================================================================
THROUGHPUT:
  Walk-In:   246
  Drive-Thru: 311
  Mobile:    180
  TOTAL:     737
--------------------------------------------------------------------------------
WAIT TIMES (Arrival -> Food Ready/Depart) [Minutes]:
  CHANNEL     AVG        MAX        95th %ILE
  Walk-In    5.01       14.44      11.30
  Drive-Thru 4.98       13.41      10.13
  Mobile     4.19       12.31      9.19
--------------------------------------------------------------------------------
LOSS ANALYSIS:
  Drive-Thru Balks: 1
  Mobile Reneges:   3
  Food Waste Cost:  $7.80
--------------------------------------------------------------------------------
FINANCIALS:
  Gross Revenue:    $7,539.50
  Food Costs:       $970.35
  Labor Cost:       $1,976.80 (7 Staff)
  Penalties:        $73.40
  NET PROFIT:       $4,518.95
--------------------------------------------------------------------------------
RESOURCE UTILIZATION:
```

```
  STATION     BUSY TIME (m)   CAPACITY    UTIL %
  URN         172.37          2           8.98
  ESPRESSO    419.92          2           21.87
  FOOD        986.73          2           51.39
  PACKER      532.42          1           55.46
  SEATING     1799.98         10          18.75
  BUSSER      67.50           1           7.03
================================================================================

>>> RUNNING REPLICATION WITH INTERNAL SEED 30...

--- STARTING INTEGRATED SIMULATION (LANE CAP: 8) ---
[Time 154.59] ESPRESSO MACHINE MAINTENANCE STARTED (7.83 min).
[Time 162.43] ESPRESSO MACHINE ONLINE.
[Time 365.52] ESPRESSO MACHINE MAINTENANCE STARTED (7.90 min).
[Time 373.42] ESPRESSO MACHINE ONLINE.


================================================================================
                        FINAL STATISTICS -- SEED 30
================================================================================
THROUGHPUT:
  Walk-In:    246
  Drive-Thru: 310
  Mobile:     180
  TOTAL:      736
--------------------------------------------------------------------------------
WAIT TIMES (Arrival -> Food Ready/Depart) [Minutes]:
  CHANNEL      AVG         MAX        95th %ILE
  Walk-In     5.10        15.31       11.81
  Drive-Thru  4.95        14.78       10.34
  Mobile      4.04        12.62       8.87
--------------------------------------------------------------------------------
LOSS ANALYSIS:
  Drive-Thru Balks: 2
  Mobile Reneges:   4
  Food Waste Cost:  $11.50
--------------------------------------------------------------------------------
FINANCIALS:
  Gross Revenue:   $7,537.80
  Food Costs:      $974.10
  Labor Cost:      $1,976.80 (7 Staff)
  Penalties:       $100.60
  NET PROFIT:      $4,486.30
--------------------------------------------------------------------------------
RESOURCE UTILIZATION:
  STATION     BUSY TIME (m)   CAPACITY    UTIL %
  URN         162.21          2           8.45
  ESPRESSO    415.76          2           21.65
  FOOD        978.86          2           50.98
  PACKER      532.75          1           55.49
  SEATING     1937.48         10          20.18
  BUSSER      67.50           1           7.03
================================================================================

>>> RUNNING REPLICATION WITH INTERNAL SEED 42...

--- STARTING INTEGRATED SIMULATION (LANE CAP: 8) ---
[Time 89.89] ESPRESSO MACHINE MAINTENANCE STARTED (5.82 min).
[Time 95.71] ESPRESSO MACHINE ONLINE.
[Time 912.69] ESPRESSO MACHINE MAINTENANCE STARTED (10.27 min).
[Time 922.96] ESPRESSO MACHINE ONLINE.


================================================================================
                        FINAL STATISTICS -- SEED 42
================================================================================
THROUGHPUT:
  Walk-In:    246
  Drive-Thru: 308
  Mobile:     180
  TOTAL:      734
--------------------------------------------------------------------------------
WAIT TIMES (Arrival -> Food Ready/Depart) [Minutes]:
  CHANNEL      AVG         MAX        95th %ILE
```

```
  Walk-In      5.18        15.98       12.52
  Drive-Thru   5.06        15.38       11.51
  Mobile       4.25        13.78        9.84
--------------------------------------------------------------------------------
LOSS ANALYSIS:
  Drive-Thru Balks: 4
  Mobile Reneges:   5
  Food Waste Cost: $13.75
--------------------------------------------------------------------------------
FINANCIALS:
  Gross Revenue:   $7,524.00
  Food Costs:      $974.25
  Labor Cost:      $1,976.80 (7 Staff)
  Penalties:       $134.50
  NET PROFIT:      $4,438.45
--------------------------------------------------------------------------------
RESOURCE UTILIZATION:
  STATION    BUSY TIME (m)   CAPACITY   UTIL %
  URN        164.40          2          8.56
  ESPRESSO   419.14          2          21.83
  FOOD       998.43          2          52.00
  PACKER     528.69          1          55.07
  SEATING    2232.43         10         23.25
  BUSSER     67.50           1          7.03
================================================================================

################################################################################
                    CROSS-REPLICATION SUMMARY (5 RUNS)
################################################################################
METRIC              MEAN            95% CI (+/-)
----------------------------------------------------------------
Net Profit          $4479.17        $38.26
Throughput          735.6           1.4
Avg Wait (All)      4.84            0.06
95% Tail Wait       10.84           0.68
----------------------------------------------------------------
Avg Balks/Day:   2.4
Avg Reneges/Day: 4.0
================================================================================
```

```
# Staffing
NUM_CASHIERS = 1
NUM_COOKS = 2
NUM_BARISTAS = 2
NUM_PACKERS = 1
NUM_BUSSERS = 1

# Capacities
SHELF_CAPACITY = 6
DRIVE_THRU_LANE_SIZE = 6
URN_BATCH_SIZE = 50
NUM_TABLES = 10


================================================================================
STARTING CRN SIMULATION (Same Customers, Different Internal Events)
Customer Seed: 42 | Replication Seeds: [1, 2, 5, 30, 42]
================================================================================
>>> GENERATING MASTER WORKLOAD (Seed 42)...
    Generated 738 customers.

>>> RUNNING REPLICATION WITH INTERNAL SEED 1...

--- STARTING INTEGRATED SIMULATION (LANE CAP: 6) ---
[Time 100.09] ESPRESSO MACHINE MAINTENANCE STARTED (7.55 min).
[Time 107.63] ESPRESSO MACHINE ONLINE.
[Time 691.51] ESPRESSO MACHINE MAINTENANCE STARTED (5.47 min).
[Time 696.98] ESPRESSO MACHINE ONLINE.


================================================================================
                         FINAL STATISTICS -- SEED 1
================================================================================
THROUGHPUT:
  Walk-In:    246
  Drive-Thru: 303
  Mobile:     180
  TOTAL:      729
--------------------------------------------------------------------------------
WAIT TIMES (Arrival -> Food Ready/Depart) [Minutes]:
  CHANNEL     AVG        MAX        95th %ILE
  Walk-In     5.13       14.65      11.85
  Drive-Thru  4.82       14.19      10.60
  Mobile      4.23       12.69      10.65
--------------------------------------------------------------------------------
LOSS ANALYSIS:
  Drive-Thru Balks: 9
  Mobile Reneges:   7
  Food Waste Cost:  $16.80
--------------------------------------------------------------------------------
FINANCIALS:
  Gross Revenue:    $7,435.60
  Food Costs:       $965.40
  Labor Cost:       $1,976.80 (7 Staff)
  Penalties:        $244.70
  NET PROFIT:       $4,248.70
--------------------------------------------------------------------------------
RESOURCE UTILIZATION:
  STATION     BUSY TIME (m)   CAPACITY   UTIL %
  URN         161.62          2          8.42
  ESPRESSO    403.60          2          21.02
  FOOD        992.59          2          51.70
  PACKER      520.78          1          54.25
  SEATING     1880.55         10         19.59
  BUSSER      67.50           1          7.03
================================================================================

>>> RUNNING REPLICATION WITH INTERNAL SEED 2...

--- STARTING INTEGRATED SIMULATION (LANE CAP: 6) ---
[Time 24.89] ESPRESSO MACHINE MAINTENANCE STARTED (11.94 min).
[Time 36.83] ESPRESSO MACHINE ONLINE.
[Time 104.64] ESPRESSO MACHINE MAINTENANCE STARTED (8.36 min).
[Time 113.00] ESPRESSO MACHINE ONLINE.
```

```
================================================================================
                        FINAL STATISTICS -- SEED 2
================================================================================
THROUGHPUT:
  Walk-In:   246
  Drive-Thru: 303
  Mobile:    180
  TOTAL:     729
--------------------------------------------------------------------------------
WAIT TIMES (Arrival -> Food Ready/Depart) [Minutes]:
  CHANNEL     AVG         MAX         95th %ILE
  Walk-In     5.08        13.93       11.66
  Drive-Thru  4.75        13.43       9.76
  Mobile      4.06        11.87       9.30
--------------------------------------------------------------------------------
LOSS ANALYSIS:
  Drive-Thru Balks: 9
  Mobile Reneges:   3
  Food Waste Cost:  $7.80
--------------------------------------------------------------------------------
FINANCIALS:
  Gross Revenue:    $7,455.90
  Food Costs:       $959.15
  Labor Cost:       $1,976.80 (7 Staff)
  Penalties:        $157.00
  NET PROFIT:       $4,362.95
--------------------------------------------------------------------------------
RESOURCE UTILIZATION:
  STATION     BUSY TIME (m)   CAPACITY   UTIL %
  URN         160.75          2          8.37
  ESPRESSO    418.87          2          21.82
  FOOD        970.82          2          50.56
  PACKER      516.31          1          53.78
  SEATING     1906.78         10         19.86
  BUSSER      67.50           1          7.03
================================================================================

>>> RUNNING REPLICATION WITH INTERNAL SEED 5...

--- STARTING INTEGRATED SIMULATION (LANE CAP: 6) ---
[Time 53.28] ESPRESSO MACHINE MAINTENANCE STARTED (7.44 min).
[Time 60.72] ESPRESSO MACHINE ONLINE.
[Time 835.90] ESPRESSO MACHINE MAINTENANCE STARTED (8.97 min).
[Time 844.87] ESPRESSO MACHINE ONLINE.


================================================================================
                        FINAL STATISTICS -- SEED 5
================================================================================
THROUGHPUT:
  Walk-In:   246
  Drive-Thru: 304
  Mobile:    180
  TOTAL:     730
--------------------------------------------------------------------------------
WAIT TIMES (Arrival -> Food Ready/Depart) [Minutes]:
  CHANNEL     AVG         MAX         95th %ILE
  Walk-In     4.74        12.93       10.18
  Drive-Thru  4.60        11.63       9.05
  Mobile      3.99        11.58       8.73
--------------------------------------------------------------------------------
LOSS ANALYSIS:
  Drive-Thru Balks: 8
  Mobile Reneges:   1
  Food Waste Cost:  $3.40
--------------------------------------------------------------------------------
FINANCIALS:
  Gross Revenue:    $7,470.20
  Food Costs:       $956.50
  Labor Cost:       $1,976.80 (7 Staff)
  Penalties:        $112.90
  NET PROFIT:       $4,424.00
--------------------------------------------------------------------------------
RESOURCE UTILIZATION:
```

```
  STATION     BUSY TIME (m)   CAPACITY    UTIL %
  URN         166.24          2           8.66
  ESPRESSO    416.26          2           21.68
  FOOD        979.43          2           51.01
  PACKER      521.26          1           54.30
  SEATING     1915.53         10          19.95
  BUSSER      67.50           1           7.03
================================================================================

>>> RUNNING REPLICATION WITH INTERNAL SEED 30...

--- STARTING INTEGRATED SIMULATION (LANE CAP: 6) ---
[Time 154.59] ESPRESSO MACHINE MAINTENANCE STARTED (7.83 min).
[Time 162.43] ESPRESSO MACHINE ONLINE.
[Time 365.52] ESPRESSO MACHINE MAINTENANCE STARTED (3.91 min).
[Time 369.43] ESPRESSO MACHINE ONLINE.


================================================================================
                        FINAL STATISTICS -- SEED 30
================================================================================
THROUGHPUT:
  Walk-In:    246
  Drive-Thru: 304
  Mobile:     180
  TOTAL:      730
--------------------------------------------------------------------------------
WAIT TIMES (Arrival -> Food Ready/Depart) [Minutes]:
  CHANNEL     AVG        MAX         95th %ILE
  Walk-In     5.24       15.82       13.09
  Drive-Thru  4.93       15.34       11.00
  Mobile      4.39       14.39       9.71
--------------------------------------------------------------------------------
LOSS ANALYSIS:
  Drive-Thru Balks: 8
  Mobile Reneges:   6
  Food Waste Cost:  $13.90
--------------------------------------------------------------------------------
FINANCIALS:
  Gross Revenue:    $7,490.20
  Food Costs:       $969.75
  Labor Cost:       $1,976.80 (7 Staff)
  Penalties:        $171.80
  NET PROFIT:       $4,371.85
--------------------------------------------------------------------------------
RESOURCE UTILIZATION:
  STATION     BUSY TIME (m)   CAPACITY    UTIL %
  URN         160.94          2           8.38
  ESPRESSO    404.40          2           21.06
  FOOD        980.21          2           51.05
  PACKER      535.87          1           55.82
  SEATING     2247.38         10          23.41
  BUSSER      67.50           1           7.03
================================================================================

>>> RUNNING REPLICATION WITH INTERNAL SEED 42...

--- STARTING INTEGRATED SIMULATION (LANE CAP: 6) ---
[Time 89.89] ESPRESSO MACHINE MAINTENANCE STARTED (5.82 min).
[Time 95.71] ESPRESSO MACHINE ONLINE.
[Time 912.69] ESPRESSO MACHINE MAINTENANCE STARTED (6.98 min).
[Time 919.66] ESPRESSO MACHINE ONLINE.


================================================================================
                        FINAL STATISTICS -- SEED 42
================================================================================
THROUGHPUT:
  Walk-In:    246
  Drive-Thru: 306
  Mobile:     180
  TOTAL:      732
--------------------------------------------------------------------------------
WAIT TIMES (Arrival -> Food Ready/Depart) [Minutes]:
  CHANNEL     AVG        MAX         95th %ILE
```

```
  Walk-In     4.97      12.94     10.63
  Drive-Thru  4.92      13.60      9.96
  Mobile      4.10      11.81      8.61
-------------------------------------------------------------------------------
LOSS ANALYSIS:
  Drive-Thru Balks: 6
  Mobile Reneges:   2
  Food Waste Cost: $5.25
-------------------------------------------------------------------------------
FINANCIALS:
  Gross Revenue:   $7,483.80
  Food Costs:      $960.35
  Labor Cost:      $1,976.80 (7 Staff)
  Penalties:       $112.10
  NET PROFIT:      $4,434.55
-------------------------------------------------------------------------------
RESOURCE UTILIZATION:
  STATION    BUSY TIME (m)   CAPACITY    UTIL %
  URN        172.17          2           8.97
  ESPRESSO   413.28          2           21.53
  FOOD       975.73          2           50.82
  PACKER     536.85          1           55.92
  SEATING    1862.70         10          19.40
  BUSSER     67.50           1           7.03
===============================================================================

###############################################################################
                    CROSS-REPLICATION SUMMARY (5 RUNS)
###############################################################################
METRIC              MEAN            95% CI (+/-)
-----------------------------------------------------------
Net Profit          $4368.41        $91.73
Throughput          730.0           1.5
Avg Wait (All)      4.72            0.18
95% Tail Wait       10.50           0.96
-----------------------------------------------------------
Avg Balks/Day:   8.0
Avg Reneges/Day: 3.8
===============================================================================
```