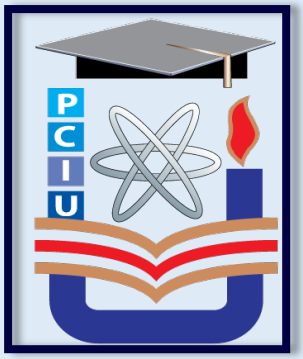


# Port City International University

# REPORT ON

**The Newspaper Seller Problem**

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**Report No : 01**

**Course Code : CSE424**

**Course Tittle : Simulation and Modeling Sessional**

| **Submitted To** | **Submitted By** |
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# The Newspaper Seller Problem

This is a classical inventory problem that concerns the purchase and sale of newspapers. Here the assumptions are:

- The paper seller buys the papers for 33 cents each and sells them for 50 cents each.
- The lost profit from excess demand is 17 cents for each paper demanded that could not be provided.
- Newspapers not sold at the end of the day are sold as scrap for 5 cents each. (the salvage value of scrap papers).
- Newspapers can be purchased in bundles of 10. Thus, the paper seller can buy 50, 60, and so on. There are three types of newsdays, "good," "fair," and "poor," with probabilities different probabilities of 0.35, 0.45, and 0.20 respectively.
- The problem is to determine the optimal number of papers the newspaper seller should purchase. /Prepare Simulation table for purchase of 70 Newspapers.
- This will be accomplished by simulating demands and recording profits from sales each day.
- The distribution of papers demanded on each of these days is given table 2.15
- Table 2.16 and 2.17 provide the random digit assignments for the types of News days and the demands for those News days.

**Distribution of newspaper demanded,**

| Demand | Good | Fair | Poor |
|---|---|---|---|
| 40 | 0.03 | 0.10 | 0.44 |
| 50 | 0.05 | 0.18 | 0.22 |
| 60 | 0.15 | 0.40 | 0.16 |
| 70 | 0.20 | 0.20 | 0.12 |
| 80 | 0.35 | 0.08 | 0.06 |
| 90 | 0.15 | 0.04 | 0.00 |
| 100 | 0.07 | 0.00 | 0.00 |

Table 01: Newspaper distribution by demand

**Random digit assignment for types of Newsday,**

| Types of Newsday | Probability | Cumulative probability | Random digit assignment |
|---|---|---|---|
| Good | 0.35 | 0.35 | 1-35 |
| Fair | 0.45 | 0.80 | 36-80 |
| Poor | 0.20 | 1.00 | 81-100 |

Table 02: Random digit for news days.

**Random digit assignment for newspaper demanded,**

| Demand | Good | Fair | Poor | Good | Fair | Poor |
|---|---|---|---|---|---|---|
| 40 | 0.03 | 0.10 | 0.44 | 01-03 | 01-10 | 02-44 |
| 50 | 0.05 | 0.18 | 0.22 | 04-08 | 11-28 | 45-66 |
| 60 | 0.15 | 0.40 | 0.16 | 09-23 | 29-68 | 67-82 |
| 70 | 0.20 | 0.20 | 0.12 | 24-43 | 69-88 | 83-94 |
| 80 | 0.35 | 0.08 | 0.06 | 44-78 | 89-96 | 95-100 |
| 90 | 0.15 | 0.04 | 0.00 | 79-93 | 97-100 | |
| 100 | 0.07 | 0.00 | 0.00 | 94-100 | | |

Table 03: Random digit for demand.

# Solution:

# Manual simulation:

# Calculation:

*Profit = [(revenue from sales) – (cost of newspapers) – (lost profit from excess demand) + (salvage from sale of scrap papers)]*

*Revenue= Demand X Selling price*

*Lost Profit = (Demand – Stock) X 17 cents [Demand> Stock]*

*Salvage = (Stock – Demand) X 5 cents [Demand< Stock]*

*Cost of Newspaper = Stock X Buying price*

*Cost of newspaper = 70 * (33/100) = 23.1*

# Manual simulation table:

| Day | RN for TON | TON | RN for Demand | Demand | revenue | lost profit | Salvage | Daily profit | pv of 70 |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 56 | fair | 63 | 60 | 30 | 0 | 0.5 | 7.4 | 23.1 |
| 2 | 50 | fair | 87 | 70 | 35 | 0 | 0 | 11.9 | 23.1 |
| 3 | 87 | poor | 53 | 50 | 25 | 0 | 1 | 2.9 | 23.1 |
| 4 | 53 | fair | 73 | 70 | 35 | 0 | 0 | 11.9 | 23.1 |
| 5 | 11 | good | 62 | 80 | 40 | 1.7 | 0 | 15.2 | 23.1 |
| 6 | 32 | good | 41 | 70 | 35 | 0 | 0 | 11.9 | 23.1 |
| 7 | 21 | good | 2 | 40 | 20 | 0 | 1.5 | -1.6 | 23.1 |
| 8 | 54 | fair | 83 | 70 | 35 | 0 | 0 | 11.9 | 23.1 |
| 9 | 24 | good | 36 | 70 | 35 | 0 | 0 | 11.9 | 23.1 |
| 10 | 77 | fair | 43 | 60 | 30 | 0 | 0.5 | 7.4 | 23.1 |
| 11 | 65 | fair | 9 | 40 | 20 | 0 | 1.5 | -1.6 | 23.1 |
| 12 | 3 | good | 100 | 100 | 50 | 5.1 | 0 | 21.8 | 23.1 |
| 13 | 24 | good | 81 | 90 | 45 | 3.4 | 0 | 18.5 | 23.1 |
| 14 | 54 | fair | 21 | 50 | 25 | 0 | 1 | 2.9 | 23.1 |
| 15 | 11 | good | 1 | 40 | 20 | 0 | 1.5 | -1.6 | 23.1 |
| 16 | 84 | poor | 28 | 40 | 20 | 0 | 1.5 | -1.6 | 23.1 |
| 17 | 42 | fair | 14 | 50 | 25 | 0 | 1 | 2.9 | 23.1 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 18 | 44 | fair | 49 | 60 | 30 | 0 | 0.5 | 7.4 | 23.1 |
| 19 | 41 | fair | 89 | 80 | 40 | 1.7 | 0 | 15.2 | 23.1 |
| 20 | 33 | good | 86 | 90 | 45 | 3.4 | 0 | 18.5 | 23.1 |
| 21 | 6 | good | 99 | 100 | 50 | 5.1 | 0 | 21.8 | 23.1 |
| 22 | 90 | poor | 31 | 40 | 20 | 0 | 1.5 | -1.6 | 23.1 |
| 23 | 52 | fair | 21 | 50 | 25 | 0 | 1 | 2.9 | 23.1 |
| 24 | 78 | fair | 94 | 80 | 40 | 1.7 | 0 | 15.2 | 23.1 |
| 25 | 81 | poor | 83 | 70 | 35 | 0 | 0 | 11.9 | 23.1 |
| 26 | 29 | good | 44 | 80 | 40 | 1.7 | 0 | 15.2 | 23.1 |
| 27 | 26 | good | 37 | 70 | 35 | 0 | 0 | 11.9 | 23.1 |
| 28 | 19 | good | 65 | 80 | 40 | 1.7 | 0 | 15.2 | 23.1 |
| 29 | 16 | good | 68 | 80 | 40 | 1.7 | 0 | 15.2 | 23.1 |
| 30 | 77 | fair | 86 | 70 | 35 | 0 | 0 | 11.9 | 23.1 |
| | | | | | 1000 | 27.2 | 13 | | 693 |

Table 4: Solution with equations.

# Simulation in excel:

| Day | RN for TON | TON | RN for Demand | Demand | revenue | lost profit | Salvage | Daily profit | pv of 70 |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 56 | fair | 63 | 60 | 30 | 0 | 0.5 | 7.4 | 23.1 |
| 2 | 50 | fair | 87 | 70 | 35 | 0 | 0 | 11.9 | 23.1 |
| 3 | 87 | poor | 53 | 50 | 25 | 0 | 1 | 2.9 | 23.1 |
| 4 | 53 | fair | 73 | 70 | 35 | 0 | 0 | 11.9 | 23.1 |
| 5 | 11 | good | 62 | 80 | 40 | 1.7 | 0 | 15.2 | 23.1 |
| 6 | 32 | good | 41 | 70 | 35 | 0 | 0 | 11.9 | 23.1 |
| 7 | 21 | good | 2 | 40 | 20 | 0 | 1.5 | -1.6 | 23.1 |
| 8 | 54 | fair | 83 | 70 | 35 | 0 | 0 | 11.9 | 23.1 |
| 9 | 24 | good | 36 | 70 | 35 | 0 | 0 | 11.9 | 23.1 |
| 10 | 77 | fair | 43 | 60 | 30 | 0 | 0.5 | 7.4 | 23.1 |
| 11 | 65 | fair | 9 | 40 | 20 | 0 | 1.5 | -1.6 | 23.1 |
| 12 | 3 | good | 100 | 100 | 50 | 5.1 | 0 | 21.8 | 23.1 |
| 13 | 24 | good | 81 | 90 | 45 | 3.4 | 0 | 18.5 | 23.1 |
| 14 | 54 | fair | 21 | 50 | 25 | 0 | 1 | 2.9 | 23.1 |
| 15 | 11 | good | 1 | 40 | 20 | 0 | 1.5 | -1.6 | 23.1 |
| 16 | 84 | poor | 28 | 40 | 20 | 0 | 1.5 | -1.6 | 23.1 |
| 17 | 42 | fair | 14 | 50 | 25 | 0 | 1 | 2.9 | 23.1 |
| 18 | 44 | fair | 49 | 60 | 30 | 0 | 0.5 | 7.4 | 23.1 |
| 19 | 41 | fair | 89 | 80 | 40 | 1.7 | 0 | 15.2 | 23.1 |
| 20 | 33 | good | 86 | 90 | 45 | 3.4 | 0 | 18.5 | 23.1 |
| 21 | 6 | good | 99 | 100 | 50 | 5.1 | 0 | 21.8 | 23.1 |
| 22 | 90 | poor | 31 | 40 | 20 | 0 | 1.5 | -1.6 | 23.1 |
| 23 | 52 | fair | 21 | 50 | 25 | 0 | 1 | 2.9 | 23.1 |
| 24 | 78 | fair | 94 | 80 | 40 | 1.7 | 0 | 15.2 | 23.1 |
| 25 | 81 | poor | 83 | 70 | 35 | 0 | 0 | 11.9 | 23.1 |
| 26 | 29 | good | 44 | 80 | 40 | 1.7 | 0 | 15.2 | 23.1 |
| 27 | 26 | good | 37 | 70 | 35 | 0 | 0 | 11.9 | 23.1 |
| 28 | 19 | good | 65 | 80 | 40 | 1.7 | 0 | 15.2 | 23.1 |
| 29 | 16 | good | 68 | 80 | 40 | 1.7 | 0 | 15.2 | 23.1 |
| 30 | 77 | fair | 86 | 70 | 35 | 0 | 0 | 11.9 | 23.1 |
| | | | | | 1000 | 27.2 | 13 | | 693 |

Figure 01: Newspaper problem solution in excel.

# Simulation using Python:

## Source Code:

```
from random import randrange
day_by_day = []
all_day = []
rn_ton = 0
ton = 0
rn_demand = 0
demand = 0
revenue = 0
lp = 0
slvg = 0
purchase_value_of_70_np = round((.33 * 70), 2)
dp = 0

def rn_for_ton(k): #2 function
  for i in range (k):
    global rn_ton, day_by_day
    day_by_day = [] # reset the list to empty
    rn_ton = randrange(100)
    day_by_day.append(i + 1)
    day_by_day.append(rn_ton)
    type_of_news_day() #3 call

def type_of_news_day(): #3 function
  global ton
  if rn_ton < 36:
    ton = "good"
  elif rn_ton < 81:
    ton = "fair"
  elif rn_ton < 101:
    ton = "poor"
  day_by_day.append(ton)

  rn_for_demand() #4 call

def rn_for_demand(): #4 function
  global rn_demand
  rn_demand = randrange(100)
  day_by_day.append(rn_demand)
  _demand() #5 call

def _demand(): #5 function
  global demand
  if ton == "poor" and rn_demand < 45:
    demand = 40
  elif ton == "poor" and rn_demand < 67:
    demand = 50
  elif ton == "poor" and rn_demand < 83:
    demand = 60
```

```
    elif ton == "poor" and rn_demand < 95:
      demand = 70
    elif ton == "poor" and rn_demand < 101:
      demand = 80
    elif ton == "fair" and rn_demand < 11:
      demand = 40
    elif ton == "fair" and rn_demand < 29:
      demand = 50
    elif ton == "fair" and rn_demand < 69:
      demand = 60
    elif ton == "fair" and rn_demand < 89:
      demand = 70
    elif ton == "fair" and rn_demand < 97:
      demand = 80
    elif ton == "fair" and rn_demand < 101:
      demand = 90
    elif ton == "good" and rn_demand < 4:
      demand = 40
    elif ton == "good" and rn_demand < 9:
      demand = 50
    elif ton == "good" and rn_demand < 24:
      demand = 60
    elif ton == "good" and rn_demand < 44:
      demand = 70
    elif ton == "good" and rn_demand < 79:
      demand = 80
    elif ton == "good" and rn_demand < 94:
      demand = 90
    elif ton == "good" and rn_demand < 101:
      demand = 100
    else:
      demand = 0

    day_by_day.append(demand)
    _revenue() #6 call

def _revenue(): #6 function
    global revenue
    revenue = demand * .5
    day_by_day.append(revenue)
    profit_lost() #7 call

def profit_lost(): #7 function
    global lp
    if demand > 70:
      lp = (demand - 70) * .17
    else:
      lp = 0
    day_by_day.append(round(lp, 2))
    salvage() #8 call
```

```
def salvage(): #8 function
  global slvg
  if demand < 70:
    slvg = (70 - demand) * .05
  else:
    slvg = 0
  day_by_day.append(slvg)
  daily_profit() #9 call

def daily_profit(): #9 function
  global dp
  dp = revenue - purchase_value_of_70_np - lp + slvg
  day_by_day.append(round(dp,2))
  day_by_day.append(purchase_value_of_70_np)
  all_day.append(day_by_day)
  #end of one loop initiated in function 2

rn_for_ton(30) #1 #2 call

import pandas as pd
df = pd.DataFrame(all_day,columns
= ['Day',' RN for TON ',' TON ',' RN for Demand ',' Demand ',' Revenue ',' Lost Profit ',' Salvage

df = df.set_index('Day')
pd.set_option('display.colheader_justify','center')

print(df)
```

## Output:

| Day | RN for TON | TON | RN for Demand | Demand | Revenue | Lost Profit | Salvage | Daily Profit | Purchase Value of 70 |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | good | 69 | 80 | 40.0 | 1.7 | 0.0 | 15.2 | 23.1 |
| 2 | 15 | good | 43 | 70 | 35.0 | 0.0 | 0.0 | 11.9 | 23.1 |
| 3 | 29 | good | 21 | 60 | 30.0 | 0.0 | 0.5 | 7.4 | 23.1 |
| 4 | 25 | good | 49 | 80 | 40.0 | 1.7 | 0.0 | 15.2 | 23.1 |
| 5 | 87 | poor | 63 | 50 | 25.0 | 0.0 | 1.0 | 2.9 | 23.1 |
| 6 | 18 | good | 72 | 80 | 40.0 | 1.7 | 0.0 | 15.2 | 23.1 |
| 7 | 24 | good | 61 | 80 | 40.0 | 1.7 | 0.0 | 15.2 | 23.1 |
| 8 | 34 | good | 41 | 70 | 35.0 | 0.0 | 0.0 | 11.9 | 23.1 |
| 9 | 6 | good | 3 | 40 | 20.0 | 0.0 | 1.5 | -1.6 | 23.1 |
| 10 | 23 | good | 68 | 80 | 40.0 | 1.7 | 0.0 | 15.2 | 23.1 |
| 11 | 56 | fair | 32 | 60 | 30.0 | 0.0 | 0.5 | 7.4 | 23.1 |
| 12 | 2 | good | 67 | 80 | 40.0 | 1.7 | 0.0 | 15.2 | 23.1 |
| 13 | 99 | poor | 31 | 40 | 20.0 | 0.0 | 1.5 | -1.6 | 23.1 |
| 14 | 17 | good | 80 | 90 | 45.0 | 3.4 | 0.0 | 18.5 | 23.1 |
| 15 | 84 | poor | 16 | 40 | 20.0 | 0.0 | 1.5 | -1.6 | 23.1 |
| 16 | 9 | good | 78 | 80 | 40.0 | 1.7 | 0.0 | 15.2 | 23.1 |
| 17 | 70 | fair | 59 | 60 | 30.0 | 0.0 | 0.5 | 7.4 | 23.1 |
| 18 | 5 | good | 31 | 70 | 35.0 | 0.0 | 0.0 | 11.9 | 23.1 |
| 19 | 88 | poor | 11 | 40 | 20.0 | 0.0 | 1.5 | -1.6 | 23.1 |
| 20 | 60 | fair | 67 | 60 | 30.0 | 0.0 | 0.5 | 7.4 | 23.1 |
| 21 | 7 | good | 2 | 40 | 20.0 | 0.0 | 1.5 | -1.6 | 23.1 |
| 22 | 74 | fair | 23 | 50 | 25.0 | 0.0 | 1.0 | 2.9 | 23.1 |
| 23 | 35 | good | 65 | 80 | 40.0 | 1.7 | 0.0 | 15.2 | 23.1 |
| 24 | 35 | good | 57 | 80 | 40.0 | 1.7 | 0.0 | 15.2 | 23.1 |
| 25 | 20 | good | 64 | 80 | 40.0 | 1.7 | 0.0 | 15.2 | 23.1 |
| 26 | 18 | good | 95 | 100 | 50.0 | 5.1 | 0.0 | 21.8 | 23.1 |
| 27 | 83 | poor | 79 | 60 | 30.0 | 0.0 | 0.5 | 7.4 | 23.1 |
| 28 | 83 | poor | 29 | 40 | 20.0 | 0.0 | 1.5 | -1.6 | 23.1 |
| 29 | 11 | good | 59 | 80 | 40.0 | 1.7 | 0.0 | 15.2 | 23.1 |
| 30 | 20 | good | 79 | 90 | 45.0 | 3.4 | 0.0 | 18.5 | 23.1 |

```
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```

Figure 02: Simulation in Python.