Managerial report for Speciality Toys Case study

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Contents

Introduction

Specialty Toys, Inc., is a company which sells a variety of new and innovative children's toys. They plan to introduce a new product called Weather Teddy. This variation of a talking teddy bear is made by a company in Taiwan. When a child presses Teddy's hand, the bear begins to talk. A built-in barometer selects one of five responses that predicts the weather condition. The responses range from "*It looks to be a very nice day! Have fun*" to "*I think it may rain today. Don't forget your umbrella.*". Tests with the product show that, even though it is not a perfect weather predictor, its predictions are surprisingly good. Several of Specialty's managers claimed Teddy gave predictions of the weather that were as good as many local television weather forecasters.

Research findings

They discover that the preholiday season is the best time to introduce a new toy, because many families use this time to look for new ideas for December holiday gifts. So they choose an October market entry date. But in order to get toys in its stores by October, Specialty places a one-time order with its manufacturers in June or July of each year. The demand for children's toys can be highly volatile. If a new toy catches on, a sense of shortage in the marketplace often increases the demand to high levels and large profits can be realized. However, new toys can also flop, leaving Specialty stuck with high levels of inventory that must be sold at reduced prices.

Specialty's senior sales forecaster reviews the sales history of similar products, and predicteds an expected demand of 20,000 units with a .95 probability that demand would be between 10,000 units and 30,000 units. They expect to sell Weather Teddy for $24 based on a cost of $16 per unit. If inventory remains after the holiday season, they will sell all surplus inventory for $5 per unit.

Challenges

The most important challenge the company faces is deciding **"How many units of Weather Teddy should be purchased to meet anticipated sales demand?"** If too few are purchased, sales will be lost and if too many are purchased, profits will be reduced because of low prices realized in clearance sales.

The Members of the management team suggests quantities of 15,000, 18,000, 24,000, or 28,000 units. The wide range of order quantities suggested indicates considerable disagreement concerning the market potential.

Analysis

To analyse this problem and recommend an order quantity, I will be using R programming with the data that is provided by Speciality Toys.

Gathered data

The Specialty Toys senior sales forecasters prediction is as follows:

- Expected demand = 20,000 units
- 95% probability that demand is between 10,000 units and 30,000 units

From the above information, we can deduce that this case follows a Normal Distribution with 95% of the values are in-between 10,000 and 30,000 units.

Let 'x' be the demand for the new toy, Hence:

- P(10000 < x < 30000) = 95%
- Mean μ = 20000 units

Standard Deviation (σ) calculations:

We have: **P(10000 < X < 30000) = 0.95**

This implies that there is a **5%** chance that the demand will be outside of **10,000 and 30,000** units

By symmetry of Normal distribution:

P(0 < X < 10000) = 0.05 / 2 = 0.025

Using the Normal Distribution chart, we find that **Z = -1.96**

We know that z-value

$$\mathbf{Z = (x - \mu) / \sigma}$$

$$\mathbf{-1.96 = (10000 - 20000) / \sigma}$$

Standard deviation σ **= 5102 units**

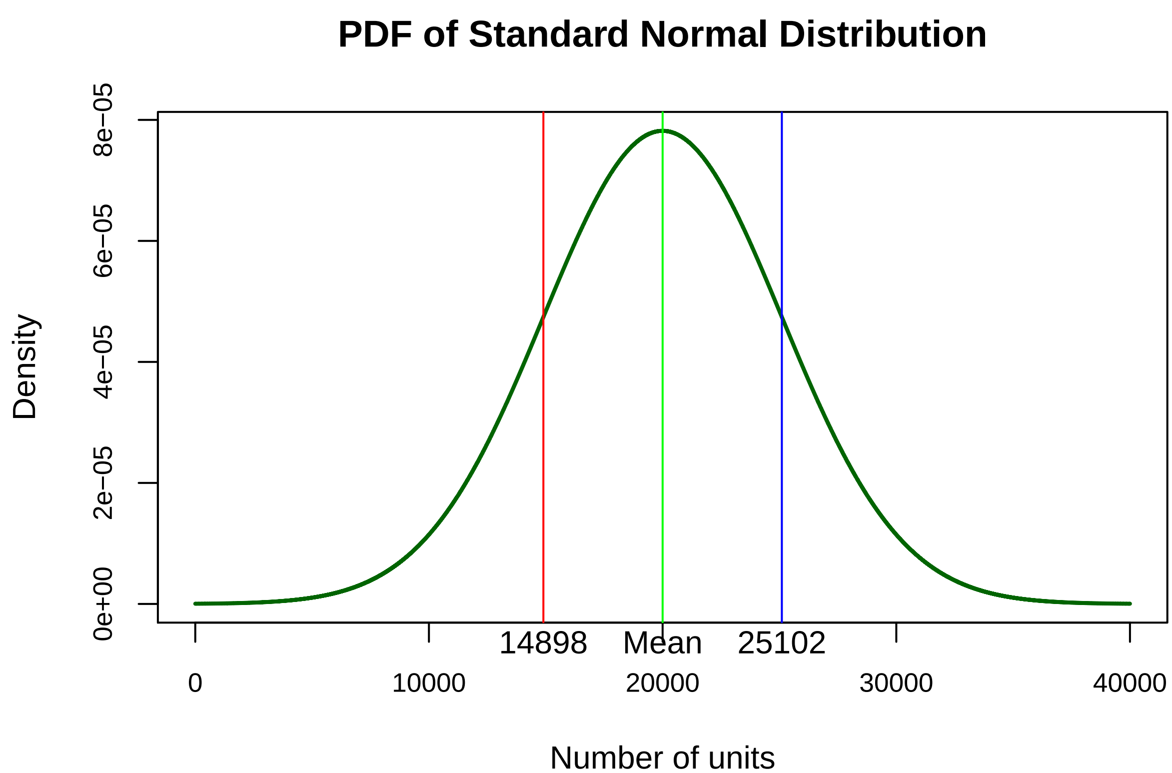
Normal Distribution Plot

Using R programming we can plot the Normal Distribution as follows:

```r
# To create a Normal distribution plot

x <- seq(0, 40000)
y <- dnorm(x, mean = 20000, sd = 5102)

# Graph is plotted using plot funtion
plot(
  x,
  y,
  col = "darkgreen",
  xlab = "Number of units",
  ylab = "Density",
  type = "l",
  main = "PDF of Standard Normal Distribution",
  lwd = 2,
  cex.axis = .8
)
abline(v=c(14898, 20000, 25102), col=rainbow(3))
mtext(c("14898", "Mean", "25102"), side=1, at = c(14898, 20000, 25102))
```



Probability of a stock-out

Probability of a stock-out for the order quantities suggested by members of the management team is calculated below.

The probability of stock out with an order of Y units is P(X > Y):

P (X > Y) = P (Z > (Y - 20000) / 5102)

Using R for calculations

```r
# Order quantities vector
Y <- c(15000, 18000, 24000, 28000)

# Z = (Y - 20000) / 5102)
Z <- (Y - 20000) / 5102

# P(Y)
probY <- pnorm(Z)

# P(X > Y) = 1 - P(Y)
probXgtY <- 1 - probY


# Making a data frame
df <- data.frame(Y, Z, probY, probXgtY)
colnames(df) <-
    c("Order quantity Y",
    "Z = (Y - 20000) / 5102)",
    "P(Y)",
    "P(X > Y) = 1 - P(Y)")

library(pander)
set.caption("Probability of a stock out")
emphasize.strong.cols(4)
pander(df)
```

Table 1: Probability of a stock out

Order quantity Y	Z = (Y - 20000) / 5102)	P(Y)	P(X > Y) = 1 - P(Y)
15000	-0.98	0.1635	**0.8365**
18000	-0.392	0.3475	**0.6525**
24000	0.784	0.7835	**0.2165**
28000	1.568	0.9416	**0.05844**

Therefore, the probability of a stock out for the order quantities 15000, 18000, 24000, 28000 units is **83.65%**, **65.17%**, **21.77%** and **5.94%** respectively.

Projected profit for different cases

The three cases under which the projected profit is calculated is as follows:

1. Worst case in which 10,000 units are sold
2. Most likely case in which 20,000 units are sold
3. Best case in which 30,000 units are sold

The selling price of Weather Teddy before/during holiday season is **$24** per unit and after the holiday season is **$5** per unit. The cost price of Weather Teddy is **$16** per unit.

Projected profit for worst case scenario

```r
# Order quantities vector
Y <- c(15000, 18000, 24000, 28000)

# Worst case sales i.e. 10000 units
worstCaseSales <- c(10000, 10000, 10000, 10000) * 24

# Surplus (Y - 10000) * 5
surplus <- (Y - 10000) * 5

# Cost of production
cost <- Y * 16

# Profit is (Sales + Surplus - Cost)
profit <- worstCaseSales + surplus - cost

# Making a data frame
worstCasedf <- data.frame(Y, worstCaseSales, surplus, cost, profit)
colnames(worstCasedf) <-
    c("Order quantity(Y)",
    "Worst case sales",
    "Surplus",
    "Cost",
    "Profit")

library(pander)
set.caption("Projected profit for worst case scenario")
emphasize.strong.cols(5)
pander(worstCasedf)
```

Table 2: Projected profit for worst case scenario

Order quantity(Y)	Worst case sales	Surplus	Cost	Profit
15000	240000	25000	240000	**25000**
18000	240000	40000	288000	**-8000**
24000	240000	70000	384000	**-74000**
28000	240000	90000	448000	**-118000**

Projected profit for most likely case scenario

```r
# Order quantities vector
Y <- c(15000, 18000, 24000, 28000)

# Most Likely case sales i.e. 20000 units
likelyCaseSales <- c(15000, 18000, 20000, 20000) * 24

# Surplus (Y - 20000) * 5
surplus <- c(0, 0, 20000, 40000)

# Cost of production
cost <- Y * 16

# Profit is (Sales + Surplus - Cost)
profit <- likelyCaseSales + surplus - cost

# Making a data frame
likelyCaseSalesdf <- data.frame(Y, likelyCaseSales, surplus, cost, profit)
colnames(likelyCaseSalesdf) <-
    c("Order quantity(Y)",
    "Likely case sales",
    "Surplus",
    "Cost",
    "Profit")

library(pander)
set.caption("Projected profit for Most Likely case scenario")
emphasize.strong.cols(5)
pander(likelyCaseSalesdf)
```

Table 3: Projected profit for Most Likely case scenario

Order quantity(Y)	Likely case sales	Surplus	Cost	Profit
15000	360000	0	240000	**120000**
18000	432000	0	288000	**144000**
24000	480000	20000	384000	**116000**
28000	480000	40000	448000	**72000**

Projected profit for best case scenario

```
# Order quantities vector
Y <- c(15000, 18000, 24000, 28000)

# Best case sales i.e. 30000 units
bestCaseSales <- c(15000, 18000, 24000, 28000) * 24

# Surplus (Y - 30000) * 5
surplus <- c(0, 0, 0, 0)


# Cost of production
cost <- Y * 16

# Profit is (Sales + Surplus - Cost)
profit <- bestCaseSales + surplus - cost

# Making a data frame
bestCaseSalesdf <- data.frame(Y, likelyCaseSales, surplus, cost, profit)
colnames(bestCaseSalesdf) <-
    c("Order quantity(Y)",
    "Likely case sales",
    "Surplus",
    "Cost",
    "Profit")

library(pander)
set.caption("Projected profit for Best case scenario")
emphasize.strong.cols(5)
pander(bestCaseSalesdf)
```

Table 4: Projected profit for Best case scenario

Order quantity(Y)	Likely case sales	Surplus	Cost	Profit
15000	360000	0	240000	**120000**
18000	432000	0	288000	**144000**
24000	480000	0	384000	**192000**
28000	480000	0	448000	**224000**

Recommendation

The report shows the overall findings in terms of mean, standard deviation, probability of stock out and also the ordering quantity and the expected profit at the different given scenarios.

Based on the report, I recommend Specialty Toys to place an order of **24000 units** of Weather Teddy's to be produced. The probability of stock out, if we produce 24000 units is 21.77% and in best case scenario, the company will make a profit of $192000. Now if we consider most likely scenario we will be selling 20000 units before holiday season and making a profit of $116000.

Since, the prediction of the weather conditions by Weather Teddy are surprisingly good we can assume that the demand for this product will be high.

The End