**Chapter 6**

**Continuous Probability Distributions**

**Case Problem: Specialty Toys**

1. Information provided by the forecaster

20,0

00

.025

10,0

00

30,0

00

.025

.95

At *x* = 30,000,





Normal distribution  

2. @ 15,000



P(stockout) = 1 - .1635 = .8365

@ 18,000



P(stockout) = 1 - .3483 = .6517

@ 24,000



P(stockout) = 1 - .7823 = .2177

@ 28,000



P(stockout) = 1 - .9418 = .0582

3. Profit projections for the order quantities under the 3 scenarios are computed below:

Order Quantity: 15,000

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | Sales | |  |
| Unit Sales | Total Cost | at $24 | at $5 | Profit |
| 10,000 | 240,000 | 240,000 | 25,000 | 25,000 |
| 20,000 | 240,000 | 360,000 | 0 | 120,000 |
| 30,000 | 240,000 | 360,000 | 0 | 120,000 |

Order Quantity: 18,000

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | Sales | |  |
| Unit Sales | Total Cost | at $24 | at $5 | Profit |
| 10,000 | 288,000 | 240,000 | 40,000 | -8,000 |
| 20,000 | 288,000 | 432,000 | 0 | 144,000 |
| 30,000 | 288,000 | 432,000 | 0 | 144,000 |

Order Quantity: 24,000

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | Sales | |  |
| Unit Sales | Total Cost | at $24 | at $5 | Profit |
| 10,000 | 384,000 | 240,000 | 70,000 | -74,000 |
| 20,000 | 384,000 | 480,000 | 20,000 | 116,000 |
| 30,000 | 384,000 | 576,000 | 0 | 192,000 |

Order Quantity: 28,000

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | Sales | |  |
| Unit Sales | Total Cost | at $24 | at $5 | Profit |
| 10,000 | 448,000 | 240,000 | 90,000 | -118,000 |
| 20,000 | 448,000 | 480,000 | 40,000 | 72,000 |
| 30,000 | 448,000 | 672,000 | 0 | 224,000 |

4. We need to find an order quantity that cuts off an area of .70 in the lower tail of the normal curve for demand.





*Q* = 20,000 + .52(5102) = 22,653

The projected profits under the 3 scenarios are computed below.

Order Quantity: 22,653

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | Sales | |  |
| Unit Sales | Total Cost | at $24 | at $5 | Profit |
| 10,000 | 362,488 | 240,000 | 63,265 | -59,183 |
| 20,000 | 362,488 | 480,000 | 13,265 | 130,817 |
| 30,000 | 362,488 | 543,672 | 0 | 181,224 |

5. A variety of recommendations are possible. The students should justify their recommendation by showing the projected profit obtained under the 3 scenarios used in parts 3 and 4. An order quantity in the 18,000 to 20,000 range strikes a good compromise between the risk of a loss and generating good profits.

While the students don't have the benefit of the following, a single-period inventory model (sometimes called the news vendor model) shows how to find an optimal solution. We outline that solution below.

A single-period inventory model recommends an order quantity that maximizes expected profit based on the following formula:



where is the probability that demand is less than or equal to the recommended order quantity,. is the cost of underestimating demand (having lost sales because of a stockout) andis the cost per unit of overestimating demand (having unsold inventory). Specialty will sell Weather Teddy for $24 per unit. The cost is $16 per unit. So, = $24 - $16 = $8. If inventory remains after the holiday season, Specialty will sell all surplus inventory for $5 a unit. So, = $16 - $5 = $11.









The profit projections for this order quantity are computed below:

Order Quantity: 18,980

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | Sales | |  |
| Unit Sales | Total Cost | at $24 | at $5 | Profit |
| 10,000 | 303,680 | 240,000 | 44,900 | -18,780 |
| 20,000 | 303,680 | 455,520 | 0 | 151,840 |
| 30,000 | 303,680 | 455,520 | 0 | 151,840 |