

# **Process Analysis and Improvement**

## **(DM-342/IB-316)**

### **End Term Examination, Trimester III, Batch 2019-21**

Time allowed: 90 minutes

Max Marks: 30

Read the case study given below and answer the questions that follow on separate sheets of paper.

With headquarters in Winnipeg, Sat TV was a dominant TV service provider for a number of neighbouring counties. Sat's primary revenues came from monthly subscriptions, and primary variable costs came from fees paid to cable networks such as HBO, MTV, etc. Nat's average variable costs were \$0.25 per channel per subscriber per month.

#### **Subscribers**

Subscribers chose from among three plans (see Table below).

Plan	Monthly Fee
Bronze	\$70
Silver	\$85
Gold	\$110

Typically, 50% of Sat's subscribers opted for the Bronze package, 30% Silver, and 20% Gold. An average subscriber was active for 40 weeks.

#### **Set-top Box Ordering**

As part of the chosen plan, all subscribers rented a set-top box called the Sat Box that converted digital signal into viewable content on TV. All plans used the same box model, which was supplied by Ultra Electronics. Ultra sold the boxes to Sat for \$208 each, while Sat charged a flat rent of \$10 per month on each box from its subscribers. After subscribers placed their box order, a Sat technician visited them and installed the box. The visit usually took 1.5 hours and cost Sat \$40 per hour of labour.

Subscribers could keep the Sat Box for as long as their subscription was active (average 40 weeks, as given earlier). The company typically activated 2000 boxes and deactivated 2000 boxes each week. Deactivated boxes were returned in three weeks on average, and it took an additional week for the box to arrive at the centralized box service centre.

#### **Box Service Centre Operations**

All boxes returned to the service centre first arrived at the Receiving Centre (RC). RC boxes waited in a storage room until an administrative assistant was available. Assistants retrieved the boxes and logged their serial numbers into a database. Each week, an average of 2000 boxes arrived at the RC, and 10,000 boxes could be found waiting at any given time. Received boxes, after logging their details, were moved to Clean and Screen Centre (C&S).

Each box spent an average of three weeks in C&S, but most of that time was spent in a C&S Waiting Area. Technicians evaluated each box's hardware to determine what service each box needed. Boxes either required the Serviceable Devices process (for boxes with no hardware defects) or the Unserviceable Devices process (for boxes with hardware defects). About 70% of boxes went to Serviceable Devices (SD) storage, while the remaining 30% went to the Unserviceable Devices (UD) storage.

### **SD Process**

In the SD process, technicians first moved the boxes from SD storage to the Software Update Centre. Here, typically 20% of the boxes were found to have undiagnosed hardware defects. The defective boxes were redirected to UD storage to begin the UD process. The remaining boxes were updated with the latest software and then were sent to the Shipping Centre.

### **UD Process**

In the UD process, technicians first moved boxes from UD storage to the Technical Evaluation Centre. Technicians recorded the repair parts each box needed. They then faxed a parts order form to Ultra Electronics. It commonly took Ultra three weeks to fulfil orders. During that time, boxes were stored in a room called Waiting for Parts (WP).

When repair parts arrived, an assistant retrieved the corresponding box from WP, taped the parts in a bag to the top of the box, and moved the unit to the Repair Station (RS). Most boxes spent two weeks in RS, but the majority of this time was spent in the Waiting for Repair (WFR) storage. Available technicians repaired the boxes and updated their software. The boxes were then moved to the Shipping Centre. UD boxes cost an average of \$50 per box in repair parts and labour, while SD boxes cost \$5 per box in labour.

### **Shipping Centre**

Once the boxes arrived at the Shipping Centre, an assistant printed shipping labels and order forms. The boxes were then packaged and distributed to Sat warehouses. Soon after, technicians delivered them to subscribers' homes. Once shipped, the time spent by the boxes before being fitted at a customer home may be ignored.

### **Key Performance Indicator: Utilization**

Sat was under heavy pressure to generate revenue from each box. Managers therefore focused on box utilization as a key performance indicator. Management's main goal was to keep utilization above 60% (the assumption

was that if 60% of the boxes were on active rent, then Sat was generating profits). Thus, utilization was measured as the ratio of the number of boxes on active rent, at any given time, to the total number of boxes (i.e., active + those under Box Service Operations).

As stated earlier, Sat paid \$208 per box. Sat followed a straight-line depreciation over 4 years – the average box's useful life. Outdated boxes had minimal salvage value and were returned to Ultra for recycling.

### **Last Year's Operations**

Last year's Sat Operations Report noted the following information:

- The number of units waiting in SD storage was 2,800.
- The number of units waiting in UD storage was 1,760.
- Company policy required three weeks of box demand to be in the Shipping Centre at all times (weekly demand = number of boxes activated every week).

### **This Year's Operations**

This year, managers were anxious about Seven Samurai TV, a new competitor which was rapidly luring customers by offering no-contract plans. Sat managers were alarmed about the potential damage to demand and utilization, but were divided on how to respond.

- Q.1 Draw an overall process map of the Sat Box rental and servicing process. Please represent activities as boxes and storage as triangles. Start from the time that the box spends with the subscriber (40 weeks), followed by the transit time when a box is deactivated (spends average 4 weeks before entering the Sat Service Centre), and so on. End when the serviced box is sent out from the Shipping Centre back to customers.  
(8 marks)
- Q.2 What is the average flow rate, in boxes per week, through this process?  
(2 marks)
- Q.3 What was the average time spent by a box in each buffer (storage) last year? To answer this question, consider 9 'storage' stages – 'with the Subscriber' (40 weeks), Box Return (4 weeks), Receiving, C&S Waiting, SD Storage, UD Storage, WP, WFR, and Shipping Centre. In some cases, the waiting times are directly given. In the others, use Little's Law.  
(10 marks)
- Q.4 What utilization did Sat achieve last year? (Utilization = number of boxes on rent / total number of boxes owned by Sat)?  
(5 marks)
- Q.5 Is there a better measure of utilization? If yes, can you define it, and determine its value for last year?  
(5 marks)