**Chapter 7: Capacity Planning**

**Practice Problems**

**MULTIPLE CHOICE**

Consolidated Industries sells many medical products. They have recently purchased another company that manufactures medical creams—Xycame, Osymine, and Glixon. Consolidated Industries plans on producing these creams at the acquired company’s facility, but they believe that they can increase the demand with better marketing. The facility that produces these creams operates on a1– eight hour shift a day for 310 days each year. The estimated annual demand and the productivity of the packaging machine are given below.

|  |  |  |  |
| --- | --- | --- | --- |
|  | Xycame | Osymine | Glixon |
| Demand | 3,000,000 | 3,500,000 | 7,500,000 |
| Minutes/Unit Machine | 0.040 | 0.035 | 0.030 |

1. How many packaging machines would be required to meet the annual demand for Xycame?

|  |  |
| --- | --- |
| a. | 1 |
| b. | 2 |
| c. | 3 |
| d. | 4 |

ANS: A PTS: 1 DIF: Easy

2. How many packaging machines would be required to meet the annual demand for Osymine?

|  |  |
| --- | --- |
| a. | 1 |
| b. | 2 |
| c. | 3 |
| d. | 4 |

ANS: A PTS: 1 DIF: Easy

3. How many packaging machines would be required to meet the annual demand for Glixon?

|  |  |
| --- | --- |
| a. | 1 |
| b. | 2 |
| c. | 3 |
| d. | 4 |

ANS: B PTS: 1 DIF: Easy

4. There was a fire at the facility of the acquired company. Consolidated Industries now has to rebuild the packaging facilities. They have the option of purchasing the same machines that they had previously used or they could purchase new machines with the following productivity levels—see the table below.

|  |  |  |  |
| --- | --- | --- | --- |
|  | Xycame | Osymine | Glixon |
| Demand | 3,000,000 | 3,500,000 | 7,500,000 |
| Minutes/Unit Older Machine | 0.040 | 0.035 | 0.030 |
| Minutes/Unit Newer Machine | 0.033 | 0.030 | 0.022 |

How many of the new packaging machines would be required to meet the annual demand for Xycame?

|  |  |
| --- | --- |
| a. | 1 |
| b. | 2 |
| c. | 3 |
| d. | 4 |

ANS: A PTS: 1 DIF: Easy

5. How many of the new packaging machines would be required to meet the annual demand for Osymine?

|  |  |
| --- | --- |
| a. | 1 |
| b. | 2 |
| c. | 3 |
| d. | 4 |

ANS: A PTS: 1 DIF: Easy

6. How many of the new packaging machines would be required to meet the annual demand for Glixon?

|  |  |
| --- | --- |
| a. | 1 |
| b. | 2 |
| c. | 3 |
| d. | 4 |

ANS: B PTS: 1 DIF: Easy

7. Let us assume that all three medical creams are tremendous market successes. Consolidated Industries anticipates a 40% increase for each of the three medical creams. How many of the newer packaging machines should Consolidated Industries purchase (in total) to meet the demand of the three medical creams? if the cost of the older machines was $200,000 each and the cost of the new machines was $300,000, what should Consolidated Industries do in order to meet the increased demand and minimize costs?

|  |  |
| --- | --- |
| a. | Purchase four of the older machines. |
| b. | Purchase three of the older machines and one of the newer machines. |
| c. | Purchase two of the older machines and two of the newer machines. |
| d. | Purchase two of the newer machines. |

ANS: A PTS: 1 DIF: Medium

8. At a Marine Corps military base there is a barbershop where each chair can handle 10 haircuts per hour. It operates with an efficiency of 85%. If the base needs to have 400 haircuts a day how many barber chairs should there be if the barber shop is open 10 hours per day?

|  |  |
| --- | --- |
| a. | 3 |
| b. | 4 |
| c. | 5 |
| d. | 10 |

ANS: C PTS: 1 DIF: Medium

9. A new airport in Tucson, Arizona has decided to use robots in their automated luggage handling system. One robot can handle 240 bags per hour. They operate at 90% efficiency, 365 days out of the year for 20 hours every day. How many robots will be needed to handle 2.8 million bags a year?

|  |  |
| --- | --- |
| a. | 1 |
| b. | 2 |
| c. | 4 |
| d. | 8 |

ANS: B PTS: 1 DIF: Medium

Menkin’s Tools produces low cost steel tools. One of their most popular tools is a steel wrench that comes in three sizes. Each of the three wrenches is forged in hydraulic presses. Data for the forging presses are given below.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | | FC | VC | SP |
| A | $200,000 | | $6.00 | $20.00 |
| B | $150,000 | | $4.50 | $18.00 |
| C | $275,000 | | $3.25 | $15.00 |

10. What is the breakeven point (in units) for Press A?

|  |  |
| --- | --- |
| a. | 10,657 |
| b. | 11,111 |
| c. | 12,432 |
| d. | 14,286 |

ANS: D PTS: 1 DIF: Medium

11. What is the breakeven point (in units) for Press B?

|  |  |
| --- | --- |
| a. | 10,657 |
| b. | 11,111 |
| c. | 12,432 |
| d. | 13,346 |

ANS: B PTS: 1 DIF: Medium

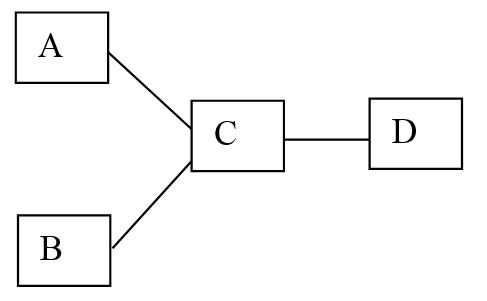
12. What is the breakeven point (in units) for Press C?

|  |  |
| --- | --- |
| a. | 14,896 |
| b. | 18,865 |
| c. | 20,960 |
| d. | 23,404 |

ANS: D PTS: 1 DIF: Medium

A production system requires four machines with the following productivity and layout:

|  |  |
| --- | --- |
| A | 20 units/ hr. |
| B | 18 units/ hr. |
| C | 15 units/ hr. |
| D | 25 units/ hr. |



13. What is the overall productivity of this system?

|  |  |
| --- | --- |
| a. | 15 |
| b. | 18 |
| c. | 20 |
| d. | 25 |

ANS: A PTS: 1 DIF: Easy

14. What was, if any, the bottleneck of this system?

|  |  |
| --- | --- |
| a. | A |
| b. | B |
| c. | C |
| d. | D |

ANS: C PTS: 1 DIF: Easy

15. With the current system how long would it take to produce 300 units?

|  |  |
| --- | --- |
| a. | 12 hours |
| b. | 20 hours |
| c. | 2 days 4 hours |
| d. | 5 days |

ANS: B PTS: 1 DIF: Medium

Nature’s Best Bakery produces four types of filled jelly rolls. Nature’s Best uses four different types of machines to fill the four types of jelly rolls. They plan on expanding production in a new geographic area. Below find the monthly demand for the four types of jelly rolls and the productivity of the four corresponding machines.

|  |  |  |
| --- | --- | --- |
|  | Demand | Fill Rate Units/Hr. |
| Yam Jams | 50,000 | 120 |
| Butters | 75,000 | 150 |
| Jellips | 40,000 | 100 |
| Yum-Yums | 85,000 | 175 |

16. Assuming that Nature’s Best Bakery runs 1–eight hour shift per day and operates 28 days a month, how many machines for the Yam Jams line will be needed?

|  |  |
| --- | --- |
| a. | 1 |
| b. | 2 |
| c. | 3 |
| d. | 4 |

ANS: B PTS: 1 DIF: Hard

17. Assuming that Nature’s Best Bakery runs 1–eight hour shift per day and operates 28 days a month, how many machines for the Butters line will be needed?

|  |  |
| --- | --- |
| a. | 1 |
| b. | 2 |
| c. | 3 |
| d. | 4 |

ANS: C PTS: 1 DIF: Hard

18. Assuming that Nature’s Best Bakery runs 1–eight hour shift per day and operates 28 days a month, how many machines for the Jellips line will be needed?

|  |  |
| --- | --- |
| a. | 1 |
| b. | 2 |
| c. | 3 |
| d. | 4 |

ANS: B PTS: 1 DIF: Hard

19. Assuming that Nature’s Best Bakery runs 1–eight hour shift per day and operates 28 days a month, how many machines for the Yum Yums line will be needed?

|  |  |
| --- | --- |
| a. | 1 |
| b. | 2 |
| c. | 3 |
| d. | 4 |

ANS: D PTS: 1 DIF: Hard

Xebec Technologies Corporation (XTC) produces three different types of « stringers » which are used in building fuselages for the aerospace industry. The manufacturing process requires three machine operations for each type of stringer. Data for the demand of each type of stringer and the productivity of each type of machine is given below.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | Machine 1 | Machine 2 | Machine 3 |
|  | Demand | Units/Hr. | Units/Hr. | Units/Hr. |
| A | 100,000 | 7 | 9 | 12 |
| B | 120,000 | 3 | 5 | 6 |
| C | 80,000 | 5 | 6.0 | 7.0 |

20. For stringer type A, how many types of Machine 1, Machine 2, and Machine 3 will be required if XTC operates 1–eight hour shift each day and for 280 days a year?

|  |  |
| --- | --- |
| a. | 3, 3, 2 |
| b. | 5, 6, 4 |
| c. | 7, 5, 4 |
| d. | 14, 9, 6 |

ANS: C PTS: 1 DIF: Hard

21. For stringer type B, how many types of Machine 1, Machine 2, and Machine 3 will be required if XTC operates 1–eight hour shift each day and for 280 days a year?

|  |  |
| --- | --- |
| a. | 7, 5, 4 |
| b. | 9, 8, 7 |
| c. | 12, 8, 6 |
| d. | 18, 11, 9 |

ANS: D PTS: 1 DIF: Hard

22. For stringer type C, how many types of Machine 1, Machine 2, and Machine 3 will be required if XTC operates 1–eight hour shift each day and for 280 days a year?

|  |  |
| --- | --- |
| a. | 7, 5, 4 |
| b. | 8, 6, 6 |
| c. | 12, 8, 6 |
| d. | 15, 9, 8 |

ANS: B PTS: 1 DIF: Hard

23. XTC’s current factory setup has fourteen of Machine type 1, eight of Machine type 2, and six of Machine type 3.The cost of each type of machine is given below.

|  |  |
| --- | --- |
|  | Price |
| Machine 1 | $250,000 |
| Machine 2 | $210,000 |
| Machine 3 | $175,000 |

For stringer type A, if 7 types of Machine 1, 5 types of Machine 2, and 4 types of Machine 3 are required if XTC operates 1–eight hour shift each day and for 280 days a year, 5, 4

In order to meet the demands, what would have to be the total cost to XTC for acquiring the correct number of additional machines?

|  |  |
| --- | --- |
| a. | $0 |
| b. | $6,200,000 |
| c. | $8,100,000 |
| d. | $9,965,000 |

ANS: D PTS: 1 DIF: Hard

24. Xebec Technologies Corporation (XTC) has developed a new (fourth) type of stringer—Type D. The possible demand and productivity of the four types of machines are given below.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Demand | Machine 1 Units/Hr. | Machine 2 Units/Hr. | Machine 3 Units/Hr. |
| A | 100,000 | 7 | 9 | 12 |
| B | 120,000 | 3 | 5 | 6 |
| C | 80,000 | 5 | 6 | 7 |
| D | 90,000 | 6 | 7 | 8 |

For stringer type D, how many types of Machine 1 will be required if XTC operates 1–eight hour shift each day and for 280 days a year?

|  |  |
| --- | --- |
| a. | 6 |
| b. | 7 |
| c. | 8 |
| d. | 9 |

ANS: B

Difficulty Level: Easy

PTS: 1

25. For stringer type D, how many types of Machine 2 will be required if XTC operates 1–eight hour shift each day and for 280 days a year?

|  |  |
| --- | --- |
| a. | 6 |
| b. | 7 |
| c. | 8 |
| d. | 9 |

ANS: A PTS: 1 DIF: Easy

26. Lebenov Medical Supplies produces screws that are used in orthopedic surgery. There are three processes that are involved in manufacturing these screws. Information on last month’s production is given in the table below.

|  |  |  |  |
| --- | --- | --- | --- |
|  | 3D Additive | Burring | Laser Scanning |
| Design Capacity | 16,000 | 30,000 | 15,000 |
| Efficiency | 0.96 | 0.89 | 0.97 |
| Actual Output | 14,896 | 25,000 | 13,976 |

What would be the capacity utilization of 3D additive, burring, and laser scanning processes, respectively?

|  |  |
| --- | --- |
| a. | 93.1%, 83.3%, 93.2% |
| b. | 91.2%, 90.6%, 96.4% |
| c. | 90.8%, 88.5%, 93.6% |
| d. | 89.1%, 87.2%, 94.1% |

ANS: A PTS: 1 DIF: Hard

Memorial Coins produces commemorative coins for businesses. They produce two size coins—large and small. The selling price, fixed cost, variable cost, and demand for the two types of coins is given below.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Selling Price | Fixed Cost | Variable Cost | Estimated Demand |
| Large | $11.00 | $13,000 | $4.00 | 25,000 |
| Small | $7.00 | $13,000 | $2.75 | 37,000 |

27. What is the breakeven point for the large coins?

|  |  |
| --- | --- |
| a. | 900 |
| b. | 1567 |
| c. | 1857 |
| d. | 3059 |

ANS: C PTS: 1 DIF: Medium

28. What is the breakeven point for the small coins?

|  |  |
| --- | --- |
| a. | 1857 |
| b. | 2578 |
| c. | 2877 |
| d. | 3059 |

ANS: D PTS: 1 DIF: Medium

Craft Ceramics produces a variety of pottery products. They produce three major products—dishes, coffee cups, and vases. The selling price, fixed cost, variable cost, and demand for the three products are given below.

|  |  |  |  |
| --- | --- | --- | --- |
|  | Selling Price | Fixed Cost | Variable Cost |
| Dishes | $10.00 | $30,000 | $5.00 |
| Coffee Mugs | $6.00 | $25,000 | $2.00 |
| Vases | $24.00 | $45,000 | $14.00 |

29. What is the breakeven point (in units) for the dishes?

|  |  |
| --- | --- |
| a. | 4500 |
| b. | 5250 |
| c. | 6000 |
| d. | 6250 |

ANS: C PTS: 1 DIF: Medium

30. What is the breakeven point (in units) for the coffee mugs?

|  |  |
| --- | --- |
| a. | 4500 |
| b. | 5250 |
| c. | 6000 |
| d. | 6250 |

ANS: D PTS: 1 DIF: Medium

31. What is the breakeven point (in units) for the vases?

|  |  |
| --- | --- |
| a. | 4500 |
| b. | 5250 |
| c. | 6000 |
| d. | 6250 |

ANS: A PTS: 1 DIF: Medium

32. Craft Ceramics is looking at purchasing new kilns. They would change the cost structure in the following way.

|  |  |  |  |
| --- | --- | --- | --- |
|  | Selling Price | Fixed Cost | Variable Cost |
| Dishes | $10.00 | $65,000 | $4.00 |
| Coffee Mugs | $6.00 | $65,000 | $1.75 |
| Vases | $24.00 | $65,000 | $12.00 |

With these new costs, what would be profits on dishes if Craft Ceramics sold 12,000 dishes?

|  |  |
| --- | --- |
| a. | -$10,000 |
| b. | $0 |
| c. | $5,000 |
| d. | $7,000 |

ANS: D PTS: 1 DIF: Medium

33. With these new costs, what would be profits on dishes if Craft Ceramics sold 6,000 vases?

|  |  |
| --- | --- |
| a. | $ 0 |
| b. | $3,000 |
| c. | $7,000 |
| d. | $9,000 |

ANS: C PTS: 1 DIF: Medium

34. What would be the difference in total profits for Craft Ceramics comparing the use of the *new* kilns and the *old* kilns if they sold 12,000 dishes, 24,000 coffee cups, and 6,000 vases?

|  |  |
| --- | --- |
| a. | -$91,000 |
| b. | -$65,000 |
| c. | $65,000 |
| d. | $91,000 |

ANS: B PTS: 1 DIF: Hard

Precision Pools produces parts for residential pools. One of their largest selling products is a pipe to carry water to and from the pool pump. Each type of pipe passes through different machine centers which operate 250 days in a year. Design capacity, efficiency, costs, and demands are given in the table below.

|  |  |  |
| --- | --- | --- |
|  | Machine Pipe 1 | Machine Pipe 2 |
| Design Capacity | 8,000 feet/day | 12,000 feet/day |
| Efficiency | 0.92 | 0.95 |
| Annual Demand | 3,000,000 feet | 7,500,000 feet |
| Fixed Cost | $280,000 | $310,000 |
| Variable Cost | $0.10 | $0.14 |
| Selling Price | $0.25 | $0.35 |

35. What would be the breakeven point for Machine Pipe 1?

|  |  |
| --- | --- |
| a. | 1,256,674 feet |
| b. | 1,476,190 feet |
| c. | 1,628,512 feet |
| d. | 1,866,667 feet |

ANS: D PTS: 1 DIF: Medium

36. What would be the breakeven point for Machine Pipe 2?

|  |  |
| --- | --- |
| a. | 1,256,674 feet |
| b. | 1,476,190 feet |
| c. | 1,628,512 feet |
| d. | 1,866,667 feet |

ANS: B PTS: 1 DIF: Medium

37. How many of Machine Pipe 1 would be needed to meet the estimated demand for type 1 pipe?

|  |  |
| --- | --- |
| a. | 1 |
| b. | 2 |
| c. | 3 |
| d. | 4 |

ANS: B PTS: 1 DIF: Hard

38. How many of Machine Pipe 2 would be needed to meet the estimated demand for type 2 pipe?

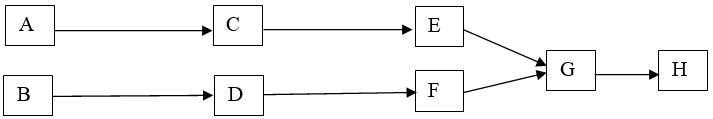
|  |  |
| --- | --- |
| a. | 1 |
| b. | 2 |
| c. | 3 |
| d. | 4 |

ANS: C PTS: 1 DIF: Hard

Hyland Plastics produces the machines that Precision Pools uses to form pipes. Hyland Plastics informed Precision Pools that they have new versions of these machines that operate at higher volumes with greater efficiencies. This was good news for Precision Pools since they had made a recent acquisition and expect a significant increase in demand. The data for the new equipment is given below.

|  |  |  |
| --- | --- | --- |
|  | New Machine Pipe 1 | New Machine Pipe 2 |
| Design Capacity | 9,800 feet/day | 15,000 feet/day |
| Efficiency | 0.99 | 0.99 |
| Annual Demand | 4,500,000 feet | 10,500,000 feet |
| Fixed Cost | $320,000 | $375,000 |
| Variable Cost | $0.07 | $0.10 |
| Selling Price | $0.25 | $0.35 |

Hyland Plastics also plans on using an existing layout to produce plastic forms for a new desk lamp.



The productivity of each machine is given below.

|  |  |
| --- | --- |
| Machine | Productivity (units/hour) |
| A | 16 |
| B | 20 |
| C | 13 |
| D | 12 |
| E | 15 |
| F | 18 |
| G | 30 |
| H | 28 |

39. What would be the breakeven point for the new Machine Pipe 1?

|  |  |
| --- | --- |
| a. | 1,200,000 |
| b. | 1,500,000 |
| c. | 1,777,778 |
| d. | 1,977,778 |

ANS: C PTS: 1 DIF: Medium

40. What would be the breakeven point for the new Machine Pipe 2?

|  |  |
| --- | --- |
| a. | 1,200,000 |
| b. | 1,500,000 |
| c. | 1,777,778 |
| d. | 1,977,778 |

ANS: B PTS: 1

41. How many of the new Machine Pipe 1 would be needed to meet the estimated demand for type 1 pipe?

|  |  |
| --- | --- |
| a. | 1 |
| b. | 2 |
| c. | 3 |
| d. | 4 |

ANS: B PTS: 1 DIF: Hard

42. How many of the new Machine Pipe 2 would be needed to meet the estimated demand for type 2 pipes?

|  |  |
| --- | --- |
| a. | 1 |
| b. | 2 |
| c. | 3 |
| d. | 4 |

ANS: C PTS: 1 DIF: Hard

43. Using the new machines, assume that Precision Pools sells 4,000,000 feet of Pipe 1 and 7,500,000 feet of Pipe 2, what would be the profit?

|  |  |
| --- | --- |
| a. | $ 400,000 |
| b. | $ 900,000 |
| c. | $1,500,000 |
| d. | $1,900,000 |

ANS: D PTS: 1 DIF: Medium

44. Which machine for the new desk lamp, if any, would be a bottleneck?

|  |  |
| --- | --- |
| a. | C |
| b. | D |
| c. | G |
| d. | H |

ANS: B PTS: 1 DIF: Easy

45. Given this setup, what would be the annual production of desk lamps assuming Hyland Plastics operates 1–eight-hour shift per day and that they operate 25 days a month?

|  |  |
| --- | --- |
| a. | 20,000 |
| b. | 28,800 |
| c. | 56,000 |
| d. | 72,000 |

ANS: B PTS: 1 DIF: Medium

46. Hyland Plastics has initiated a Lean Six-Sigma program to improve operational efficiency in producing desk lamps. Assume that they increased the efficiency of Machine E by 40%. What would be the percent increase in overall annual production of the desk lamp setup, assuming 1–eight-hour shift per day and that they operate 25 days a month?

|  |  |
| --- | --- |
| a. | 0% |
| b. | 10% |
| c. | 20% |
| d. | 40% |

ANS: A PTS: 1 DIF: Easy

47. After increasing the efficiency of Machine E by 40%, they increased the efficiency of Machine C by 50%. What would be the percent increase in overall annual production of the desk lamp setup, assuming 1–eight-hour shift per day and that they operate 25 days a month?

|  |  |
| --- | --- |
| a. | 0% |
| b. | 20% |
| c. | 40% |
| d. | 50% |

ANS: A PTS: 1 DIF: Medium

48. After increasing the efficiency of Machine E by 40%, they increased the efficiency of Machine C by 50%, and then they increased the efficiency of Machine D by 75%. What would be the percent increase in overall annual production of the desk lamp setup, assuming 1–eight-hour shift per day and that they operate 25 days a month?

|  |  |
| --- | --- |
| a. | 0% |
| b. | 33% |
| c. | 40% |
| d. | 75% |

ANS: B PTS: 1 DIF: Hard

Axion Medical Supplies manufactures hypodermic needles and other medical equipment. The machine that cuts the steel tubing into hypodermic needles has a design capacity of 6,000 needles per hour with a capacity efficiency of 95%. Axion runs eight-hour shifts.

49. If Axion produced 40,987 needles yesterday what would its capacity efficiency be?

|  |  |
| --- | --- |
| a. | 83.22% |
| b. | 85.39% |
| c. | 89.88% |
| d. | 91.23% |

ANS: C PTS: 1 DIF: Medium

50. What is Axion’s capacity utilization?

|  |  |
| --- | --- |
| a. | 83.22% |
| b. | 85.39% |
| c. | 89.88% |
| d. | 91.23% |

ANS: B PTS: 1 DIF: Easy