Production Planning & Control

Chapter 2

Aggregate Planning & Master Production Scheduling

Aggregate Planning & Master Production Scheduling

Why Aggregate Planning Is Necessary

- Fully load facilities and minimize overloading and underloading
- Make sure enough capacity available to satisfy expected demand
- Plan for the orderly and systematic change of production capacity to meet the peaks and valleys of expected customer demand
- Get the most output for the amount of resources available

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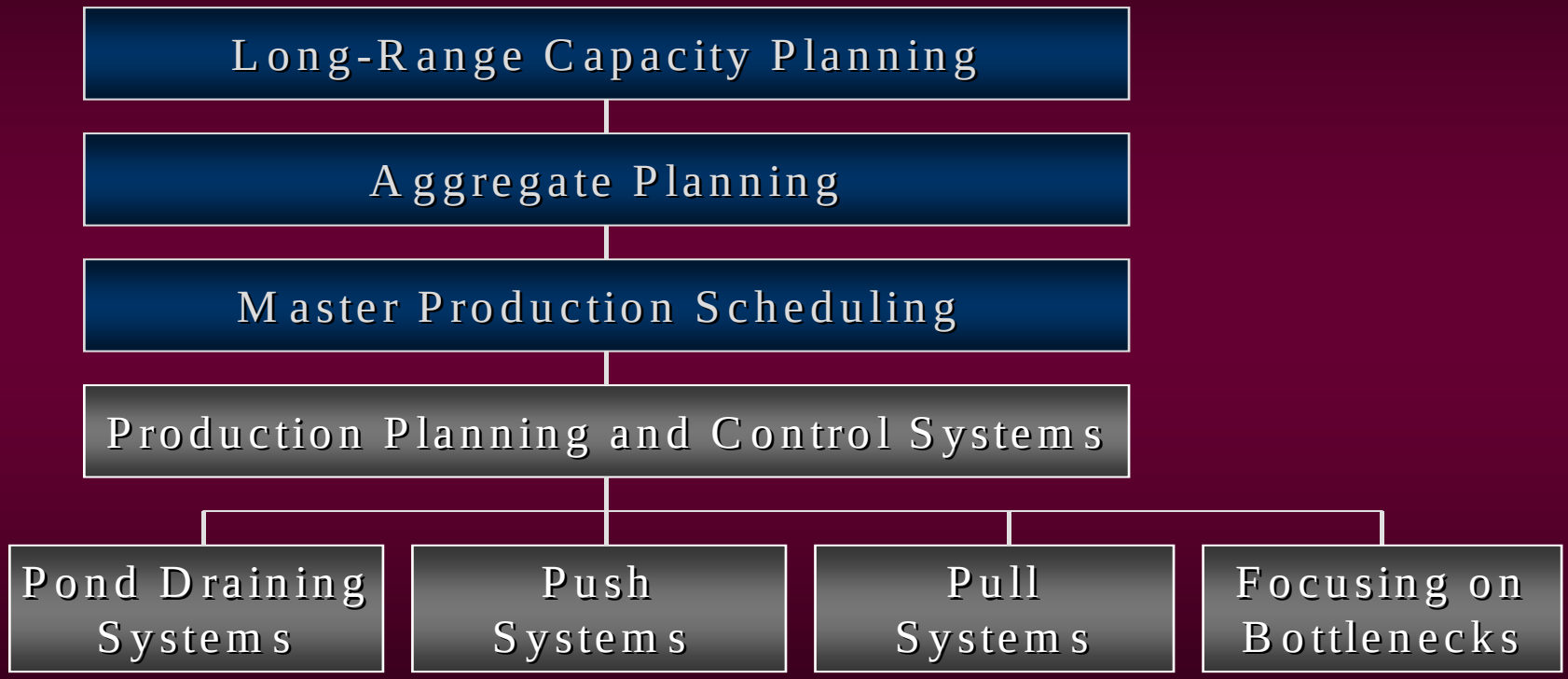
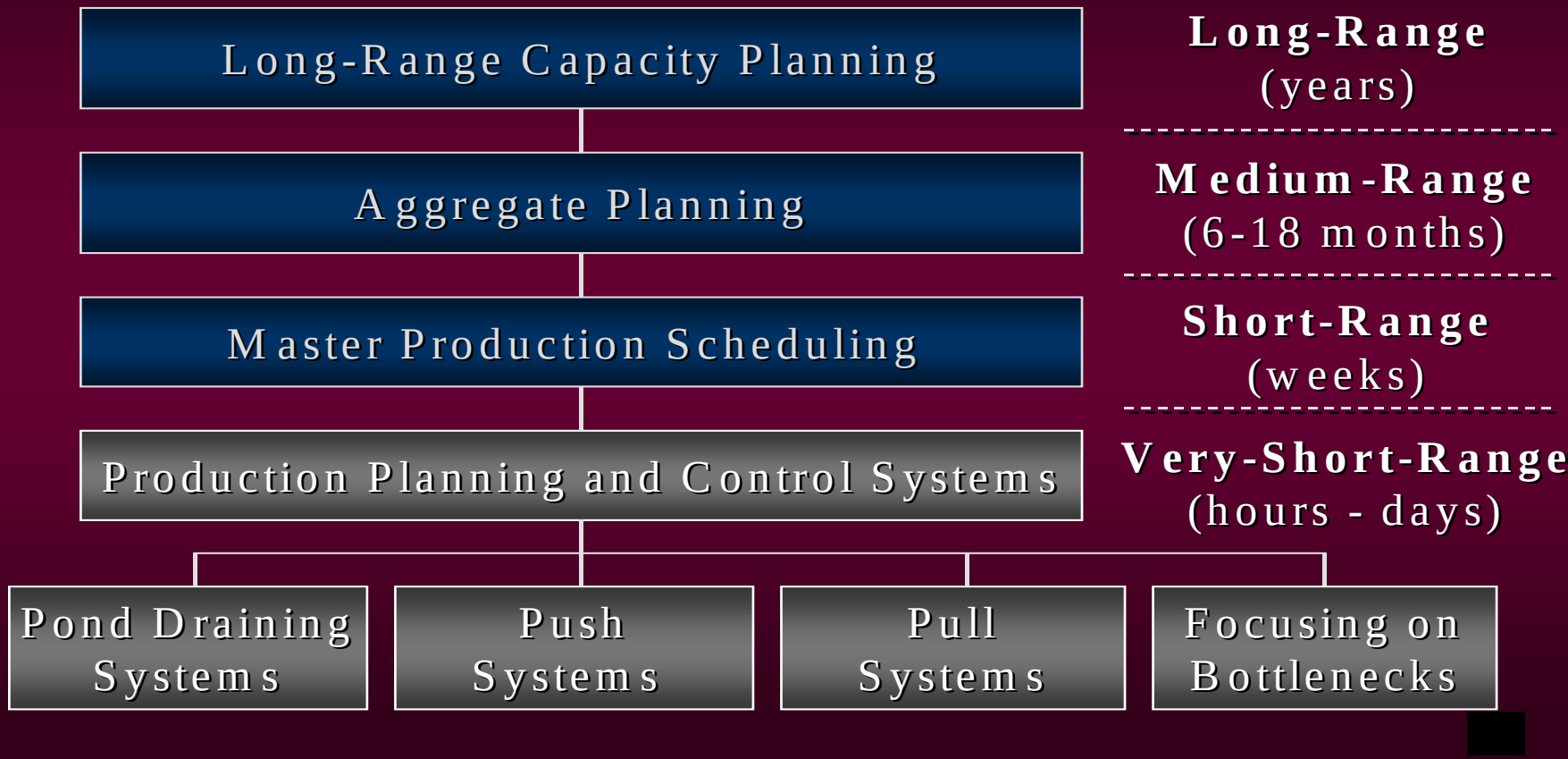
Aggregate Planning & Master Production Scheduling

Production Planning Hierarchy



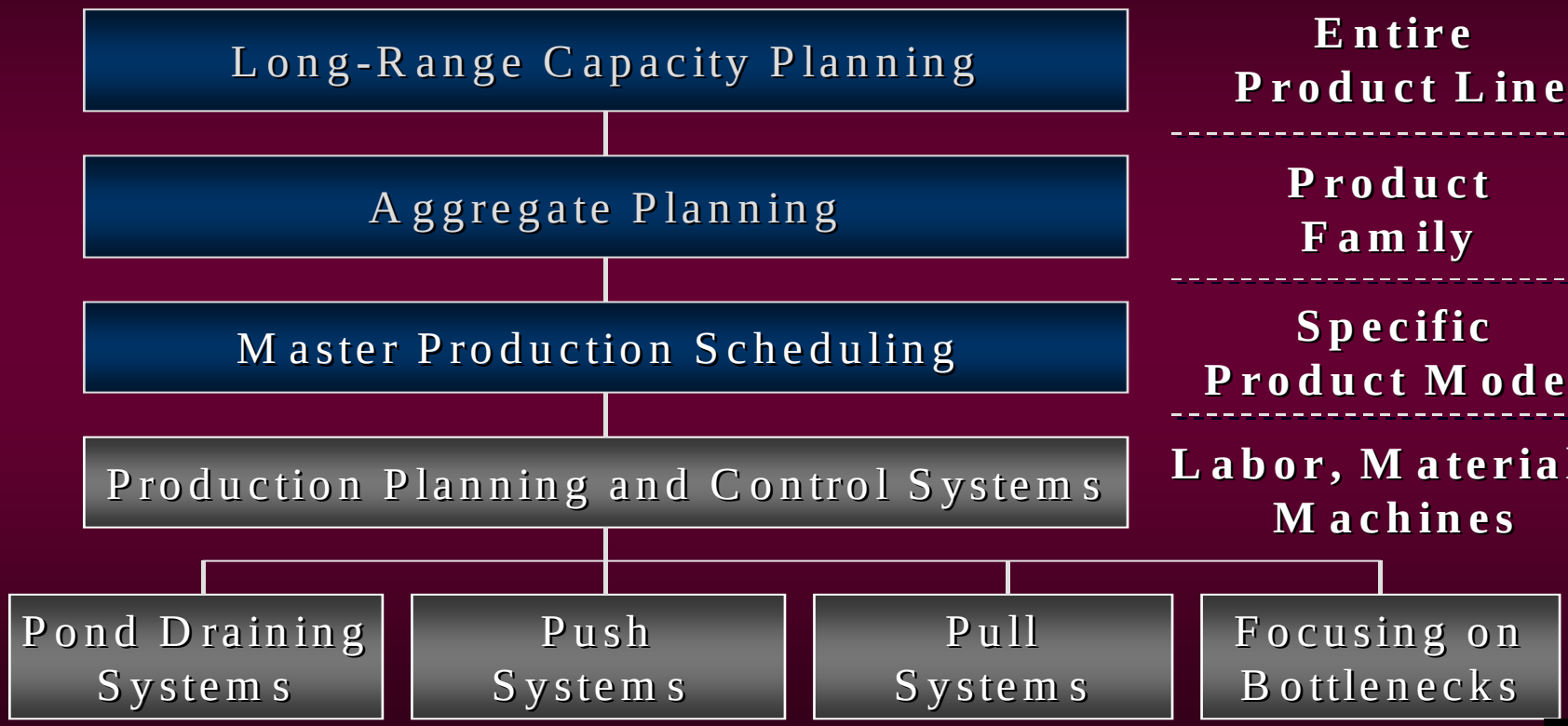
Aggregate Planning & Master Production Scheduling

Production Planning Horizons



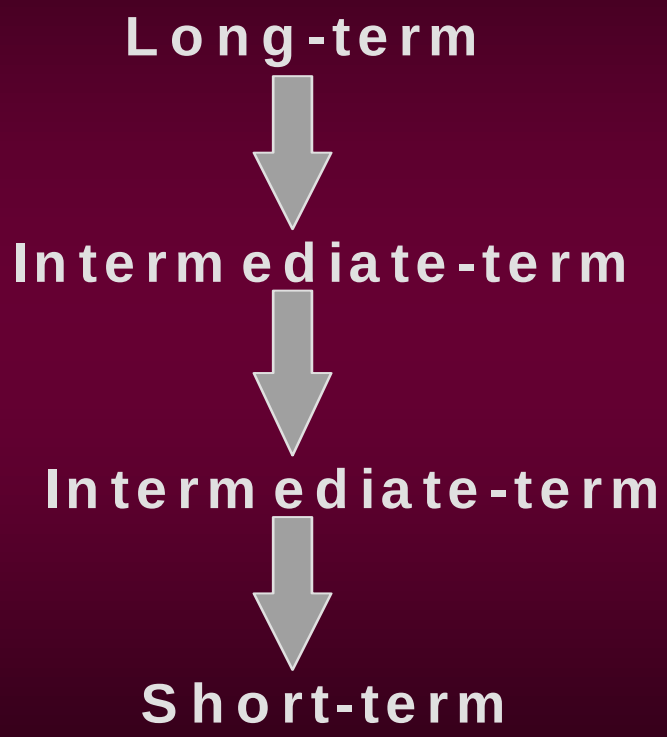
Aggregate Planning & Master Production Scheduling

Production Planning: Units of Measure



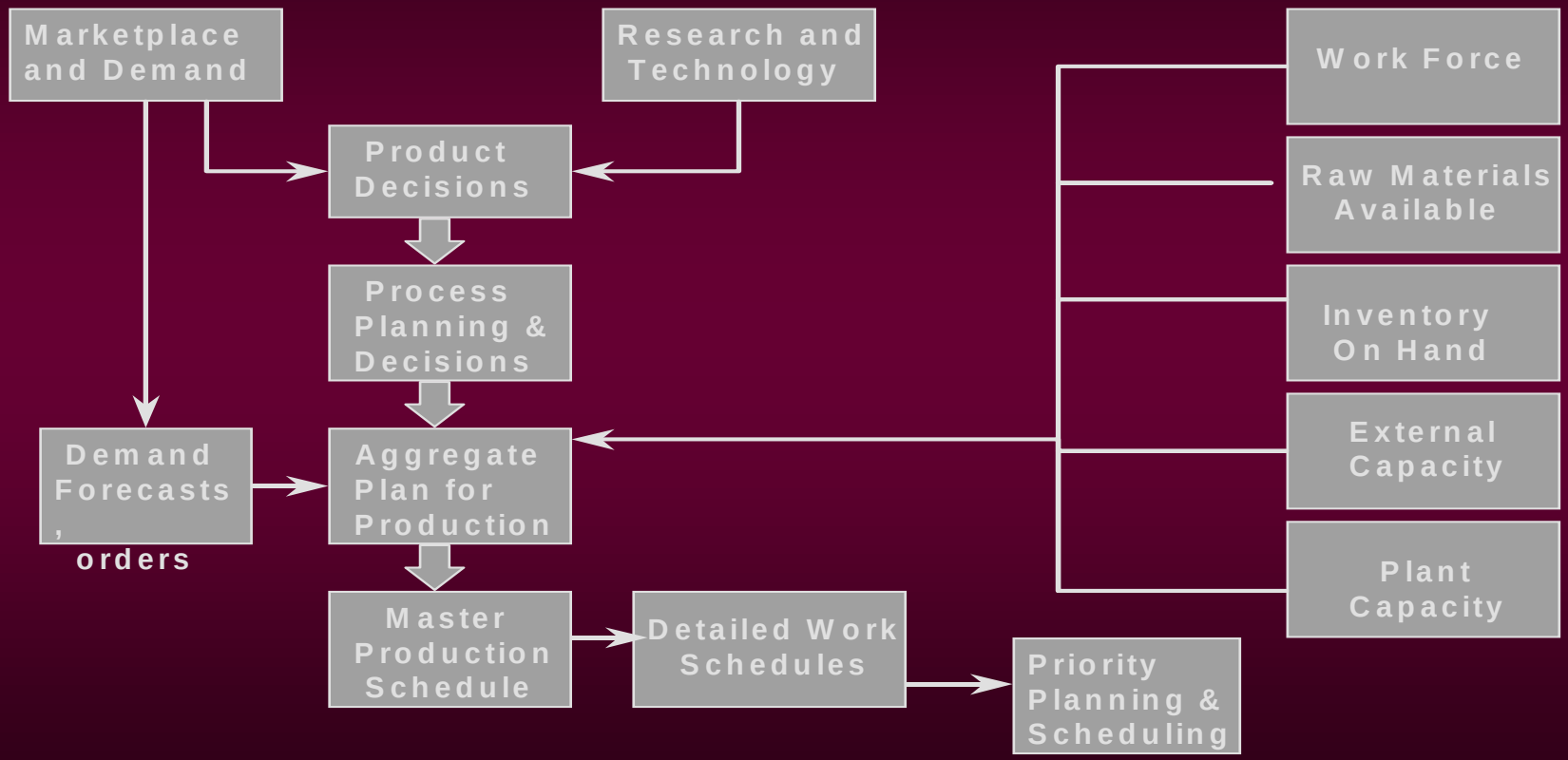
Aggregate Planning & Master Production Scheduling

Capacity Planning, Aggregate Planning, Master Schedule, and Short-Term Scheduling



Aggregate Planning & Master Production Scheduling

Relationships Between OM Elements



Aggregate Planning

Inputs

- A forecast of aggregate demand covering the selected planning horizon (6-18 months)
- The alternative means available to adjust short- to medium-term capacity, to what extent each alternative could impact capacity and the related costs
- The current status of the system in terms of workforce level, inventory level and production rate

Aggregate Planning

Outputs

- A production plan: aggregate decisions for each period in the planning horizon about
  - workforce level
  - inventory level
  - production rate
- Projected costs if the production plan was implemented

Need for Aggregate Capacity Planning

- Workforce level
  - Hire or layoff full-time workers
  - Hire or layoff part-time workers
  - Hire or layoff contract workers
- Utilization of the work force
  - Overtime
  - Idle time (under time)
  - Reduce hours worked
- Inventory level
  - Finished goods inventory
  - Backorders/lost sales
- Subcontract

Approaches to Aggregate Planning

- Top down approach
- Bottom up approach
- Informal or Trial-and-Error Approach
- Mathematically Optimal Approaches
  - Linear Programming
  - Linear Decision Rules
- Computer Search
- Heuristics

Comparison of Aggregate Planning Methods

Method	Advantages	Limitations
Graphical	■ Simple, easy to use and understand	■ Many solutions; solution need not be optimal
Linear Programming	■ Provides optimal solution ■ Popular in many industries ■ Sensitivity & dual analysis provide useful information ■ Sensitivity & dual analysis provide useful information ■ Constraints readily added	■ Mathematical functions must be linear, and deterministic -- not necessarily a realistic assumption

Comparison of Aggregate Planning Methods

Method	Advantages	Limitations
Linear Decision Rules	■ Provide optimal solution ■ Handle non-deterministic demand	■ Incorporates some non-standard costs ■ Skilled personal required ■ Quadratic model not always realistic ■ Values of variables are unconstrained ■ Feasible solution is optimal if it exists - not guaranteed
Management Coefficients Model	■ Simple, easy to use and understand ■ Attempts to duplicate manager's decision-making process ■ Simplest, least disruptive, easiest to implement	■ Solution need not be optimal ■ Assumes past decisions are good ■ Built on individual's invalidate model

Comparison of Aggregate Planning Methods

Method	Advantages	Limitations
Simulation	■ Places no restrictions on mathematical structure or cost functions ■ Can test many relationships	■ No optimal solution guaranteed ■ Often a long, costly, process

Aggregate Planning Strategies

Pure Strategies for the Informal Approach

- Matching Demand
- Level Capacity
  - Buffering with inventory
  - Buffering with backlog
  - Buffering with overtime or subcontracting

Aggregate Planning Strategies

Matching Demand Strategy

- Capacity (Production) in each time period is varied to exactly match the forecasted aggregate demand in that time period
- Capacity is varied by changing the workforce level
- Finished-goods inventories are minimal
- Labor and materials costs tend to be high due to the frequent changes

Developing and Evaluating the Matching Production Plan

- Production rate is dictated by the forecasted aggregate demand
- Convert the forecasted aggregate demand into the required workforce level using production time information
- The primary costs of this strategy are the costs of changing workforce levels from period to period, i.e., hiring and layoffs

Level Capacity Strategy

- Capacity (production rate) is held level (constant) over the planning horizon
- The difference between the constant production rate and the demand rate is made up (buffered) by inventory, backlog, overtime, part-time labor and/or subcontracting

Developing and Evaluating the Level Production Plan

- Assume that the amount produced each period is constant, no hiring or layoffs
- The gap between the amount planned to be produced and the forecasted demand is filled with either inventory or backorders, i.e., no overtime, no idle time, no subcontracting
- The primary costs of this strategy are inventory carrying and backlogging costs
- Period-ending inventories or backlogs are determined using the inventory balance equation:

$$EI_t = EI_{t-1} + (P_t - D_t)$$

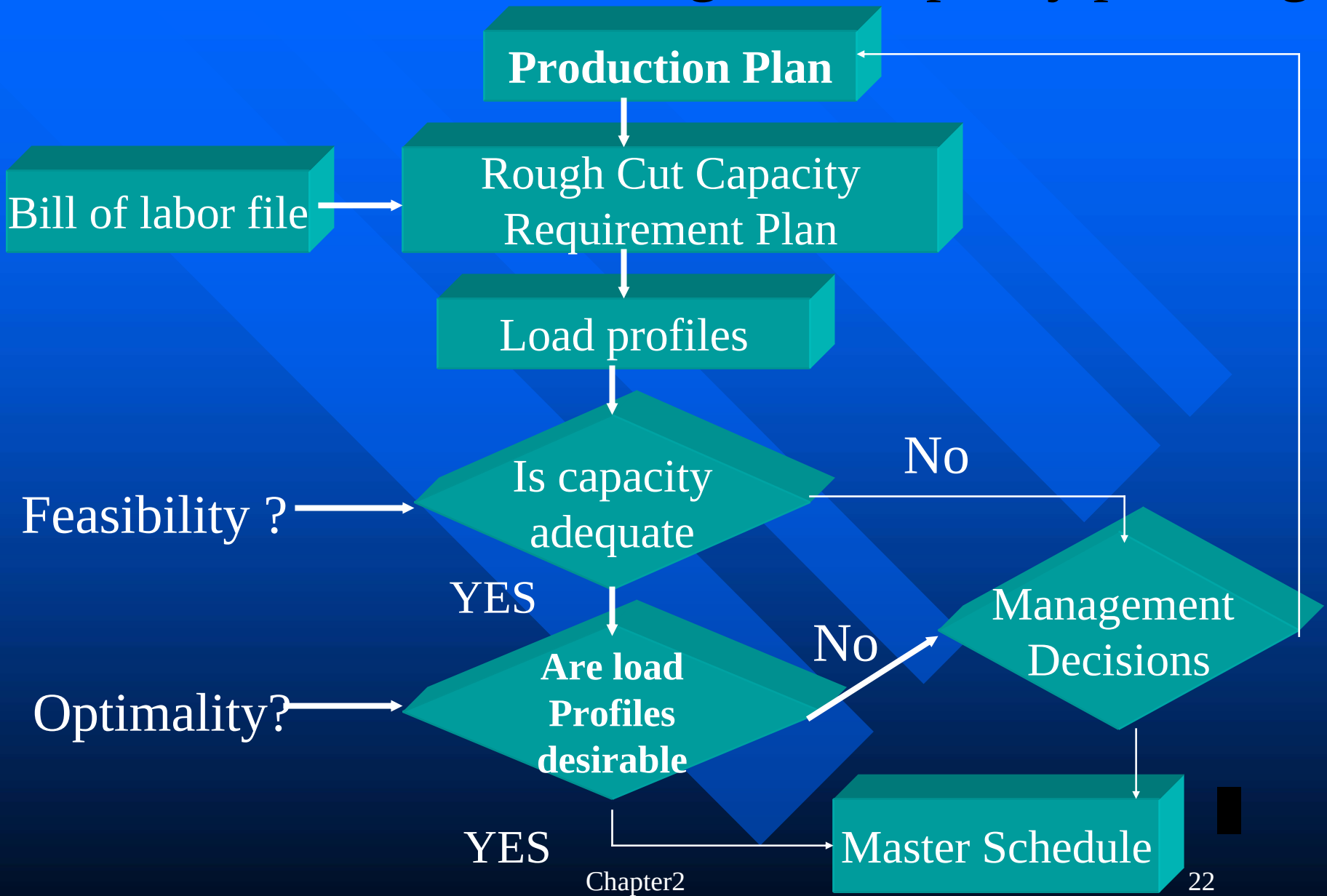
Aggregate Plans for Services

- For standardized services, aggregate planning may be simpler than in systems that produce products
- For customized services,
  - there may be difficulty in specifying the nature and extent of services to be performed for each customer
  - customer may be an integral part of the production system
- Absence of finished-goods inventories as a buffer between system capacity and customer demand

Rough Cut capacity planning

- This done in conjunction with the tentative master production schedule to test the feasibility in terms of capacity before the master production schedule is finalized
- This ensures that a proposed MPS does not overload any key department,work center or machine.
- It is typically applied to critical work centers that are most likely to bottleneck

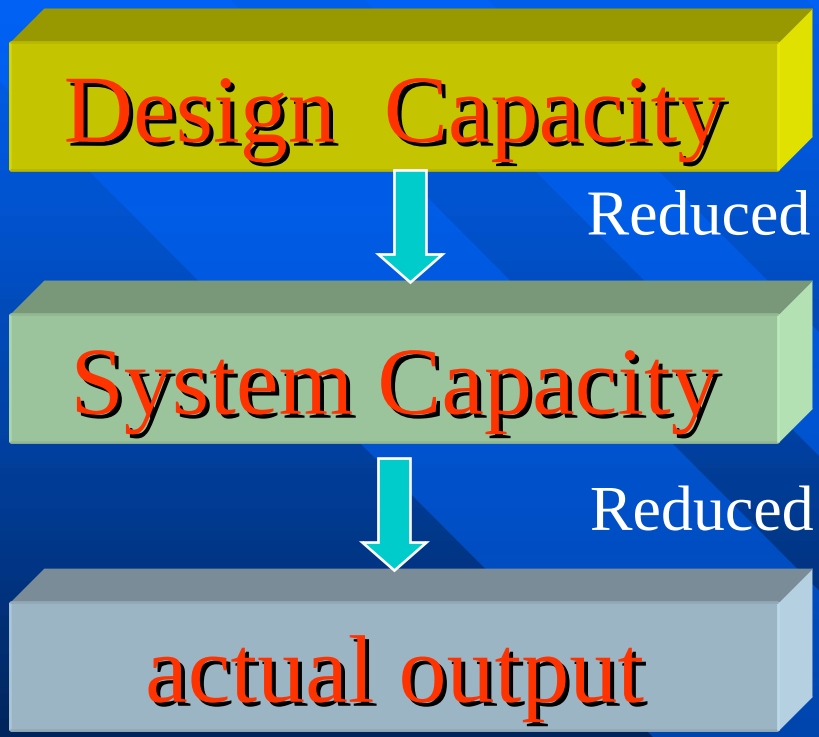
Flow chart for Rough Cut capacity planning



Types of Capacity

- Fixed capacity
- Adjustable capacity
- Design capacity
- Systems capacity
- Potential capacity
- Immediate capacity
- Actual or utilized capacity
- Normal or rated capacity
- Effective capacity

Relation between Design , System Capacity and actual output



Say 1500 tonnes of steel

Say 1200 tonnes of steel

Say 1000 tonnes of steel

Factors affecting determination of plant Capacity

- Market demand for a product/service
- The amount of capital that can be invested
- Degree of automation desired
- Flexibility for capacity addition
- Types of technology selected
- Difficulty in forecasting
- Obsolescence of product
- Level of integration

Capacity Planning

Capacity planning is concerned with defining long term & short term capacity needs of a firm and determine how these needs will be met

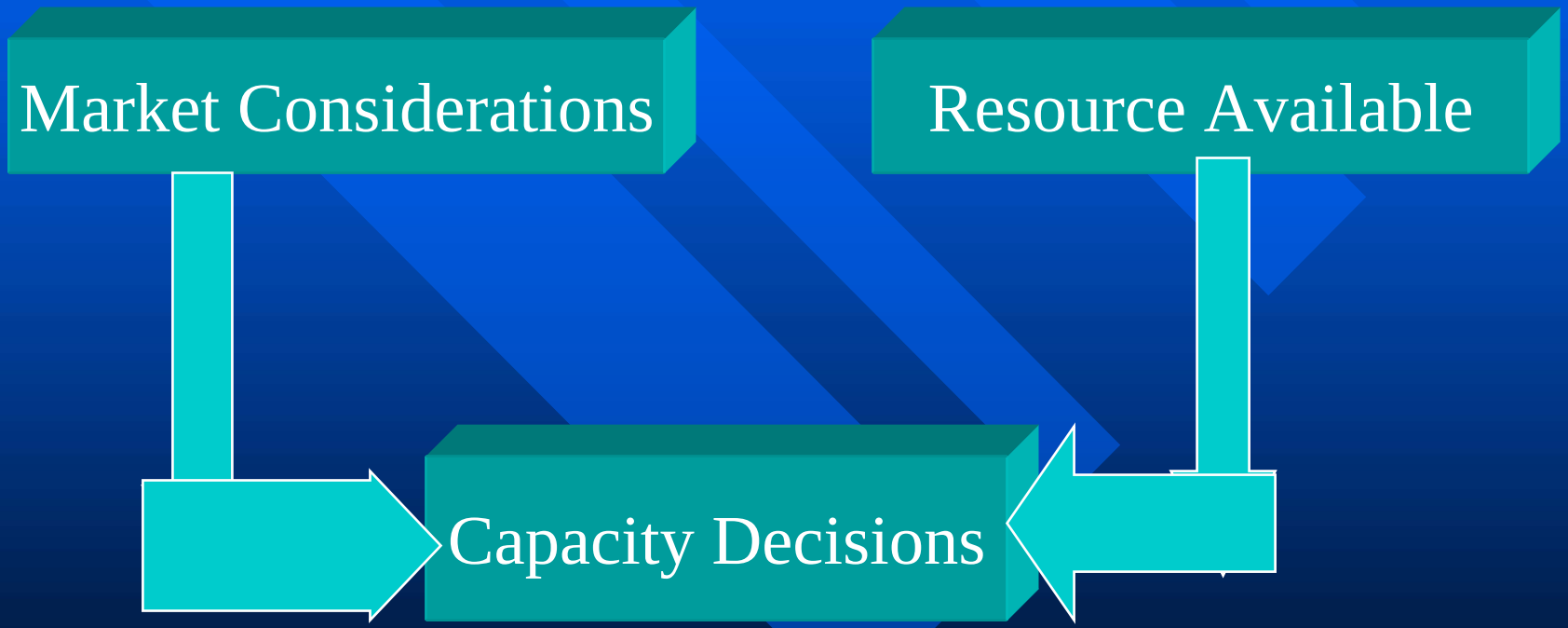
Capacity planning decisions

- Assessing existing Capacity
- Forecasting future capacity
- Identifying alternative ways
- Evaluating financial,economical,and technological alternatives

The need for Capacity Planning

- Capacity planning is necessary when the organization decides to increase its production or introduce new production to the market.
- Once the capacity is evaluated and a need for new or expanded facilities is determined ,decisions regarding facility location and process technology selections are taken

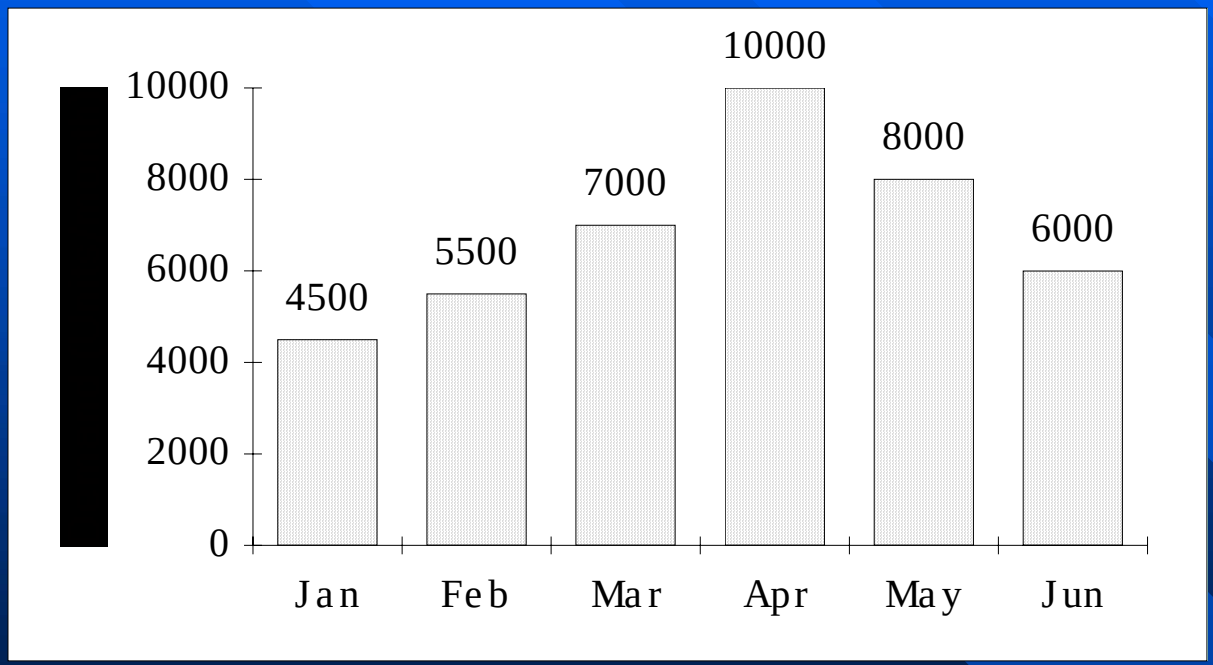
Capacity Planning Decisions



Aggregate Planning Example

A small manufacturing company with 200 employees produces umbrellas. The company produces the following three product lines: 1) the Executive Line, 2) the Durable Line and 3) the Compact line, as shown in the below

Aggregate Planning Example: *Demand for Executive Umbrellas*



Number of working days:
Jan: 22
Feb: 19
Mar: 21
Apr: 21
May: 22
Jun: 20

Aggregate Planning Example: *Cost Information for Executive Umbrellas*

Materials	$5.00	/unit
Holding costs	$1.00	/unit/month
Marginal cost of stockout	$1.25	/unit/month
Hiring & training cost	$200.00	/worker
Layoff costs	$250.00	/worker
Labor hours required	0.15	hrs/unit
Straight time labor cost	$8.00	/hr
Beginning inventory	250	units
Productive hours	7.25	hrs/worker/day
Paid straight hours	8	hrs/day
Beginning # of workers	7	workers

Aggregate Planning Example:

Determining Straight Labor Costs and Output for Executive Umbrellas

	Jan	Feb	Mar	Apr	May	Jun
Days/mo	22	19	21	21	22	20
Hrs/worker/mo	159.5	137.75	152.25	152.25	159.5	145
Units/worker	1063.33	918.33	1015	1015	1063.33	966.67
$/worker	$1,408	1,216	1,344	1,344	1,408	1,280

January

159.5 = 22 [days/month] * 7.25 [productive hrs/worker]

1063.33 = 159.5 [hrs/worker/month] / .15 [hrs/unit]

$1,408 = 8 [$/hr] * 8 [paid hrs/day] * 22 [days/month]

Aggregate Planning Example:

Determining Straight Labor Costs and Output for Executive Umbrellas

Aggregate Planning Problem						
	Jan	Feb	Mar	Apr	May	Jun
Days/month	22	19	21	21	22	20
Hrs/worker/month	160	138	152	152	160	145
Units/worker	1,063	918	1,015	1,015	1,063	967
Labor cost/worker	$1,408.00	$1,216.00	$1,344.00	$1,344.00	$1,408.00	$1,280.00

Aggregate Planning Example

Chase Strategy for Executive Umbrellas

	Jan
Days/mo	22
Hrs/worker/mo	159.5
Units/worker	1,063.33
$/worker	$1,408

	Jan
Demand	4,500
Beg. inv.	250
Net req.	4,250
Req. workers	3.997
Hired	
Fired	3
Workforce	4
Ending inventory	0

- *Objective: Adjust workforce level so as to eliminate the need to carry inventory from period to period*

- 4,500 units is the demand in January (any combination of firm orders and forecast
- 250 is the starting inventory position
- 4,250 = 4,500 – 250
- 3.997 = 4,250 / 1,063.33
- 7 = workforce level at the beginning of January
- 3 = 7 – 4 = workers fired
- 4 = workforce level at end of January
- 0 = ending inventory level

Aggregate Planning Example

Chase Strategy for Executive Umbrellas

Chase Strategy						
	Jan	Feb	Mar	Apr	May	Jun
Demand	4,500	5,500	7,000	10,000	8,000	6,000
Beginning inventory	250	0	0	0	0	0
Net requirements	4,250	5,500	7,000	10,000	8,000	6,000
Beginning # of workers	7	4	6	7	10	8
Required workers	4	6	7	10	8	6
Workforce adjustment	-3	2	1	3	-2	-1
Production quantity	4,250	5,500	7,000	10,000	8,000	6,000
Ending inventory	0	0	0	0	0	0

Aggregate Planning Example

Chase Strategy for Executive

Chase Strategy Costs							
	Jan	Feb	Mar	Apr	May	Jun	
Material cost	$21,250.00	$27,500.00	$35,000.00	$50,000.00	$40,000.00	$30,000.00	**$203,750.00**
Labor cost	$5,628.00	$7,283.00	$9,269.00	$13,242.00	$10,594.00	$7,945.00	**$53,961.00**
Hiring cost	$0.00	$400.00	$200.00	$600.00	$0.00	$0.00	**$1,200.00**
Firing cost	$750.00	$0.00	$0.00	$0.00	$500.00	$250.00	**$1,500.00**
Inventory holding cost	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	**$0.00**
Inventory stockout cost	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	**$0.00**
						TOTAL:	**$260,411.00**

January costs: $21,250.00 = 4,250 [units] * $5 [$/unit]
$ 5,627.59 = 3.997 [workers] * 1,408 [$/worker]
$ 750.00 = 3 [workers fired] * 250 [$/worker fired]

Aggregate Planning Example
Level Strategy for Executive Umbrellas

	Jan
Demand	4,500
Beg. inv.	250
Net req.	4,250
Workers	6
Production	6,380
Ending inventory	2,130
Surplus	2,130
Shortage	

- *Objective: Adjust inventory level so as to eliminate the need to hire or fire workers from period to period*
- Assume that January is started with 6 employees
- 6,380 = 6 [employees] * 1,063.33 [units/worker]
- 2,130 = 6,380 – 4,250 (surplus)

Aggregate Planning Example
Level Strategy for Executive Umbrellas

Level Capacity Strategy						
	Jan	Feb	Mar	Apr	May	Jun
Demand	4,500	5,500	7,000	10,000	8,000	6,000
Beginning inventory	250	2,130	2,140	1,230	-2,680	-4,300
Net requirements	4,250	3,370	4,860	8,770	10,680	10,300
Beginning # of workers	6	6	6	6	6	6
Required workers	4	4	5	9	10	11
Workforce adjustment	0	0	0	0	0	0
Production quantity	6,380	5,510	6,090	6,090	6,380	5,800
Ending inventory	2,130	2,140	1,230	-2,680	-4,300	-4,500

Aggregate Planning Example
Level Strategy for Executive Umbrellas

Level Capacity Strategy Costs							
	Jan	Feb	Mar	Apr	May	Jun	Total
Material cost	$31,900.00	$27,550.00	$30,450.00	$30,450.00	$31,900.00	$29,000.00	**$181,250.00**
Labor cost	$8,448.00	$7,296.00	$8,064.00	$8,064.00	$8,448.00	$7,680.00	**$48,000.00**
Hiring cost	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	**$0.00**
Firing cost	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	**$0.00**
Inventory holding cost	$2,130.00	$2,140.00	$1,230.00	$0.00	$0.00	$0.00	**$5,500.00**
Inventory stockout cost	$0.00	$0.00	$0.00	$3,350.00	$5,375.00	$5,625.00	**$14,350.00**
						TOTAL:	**$249,100.00**

January costs: $8,448 = 6 [workers] * $1,408 [$/worker]

$ 31,900 = 6,380 [units] * $5 [$/unit]

$ 2,130 = 2,130 [surplus units] * $1 [$/unit held/month]

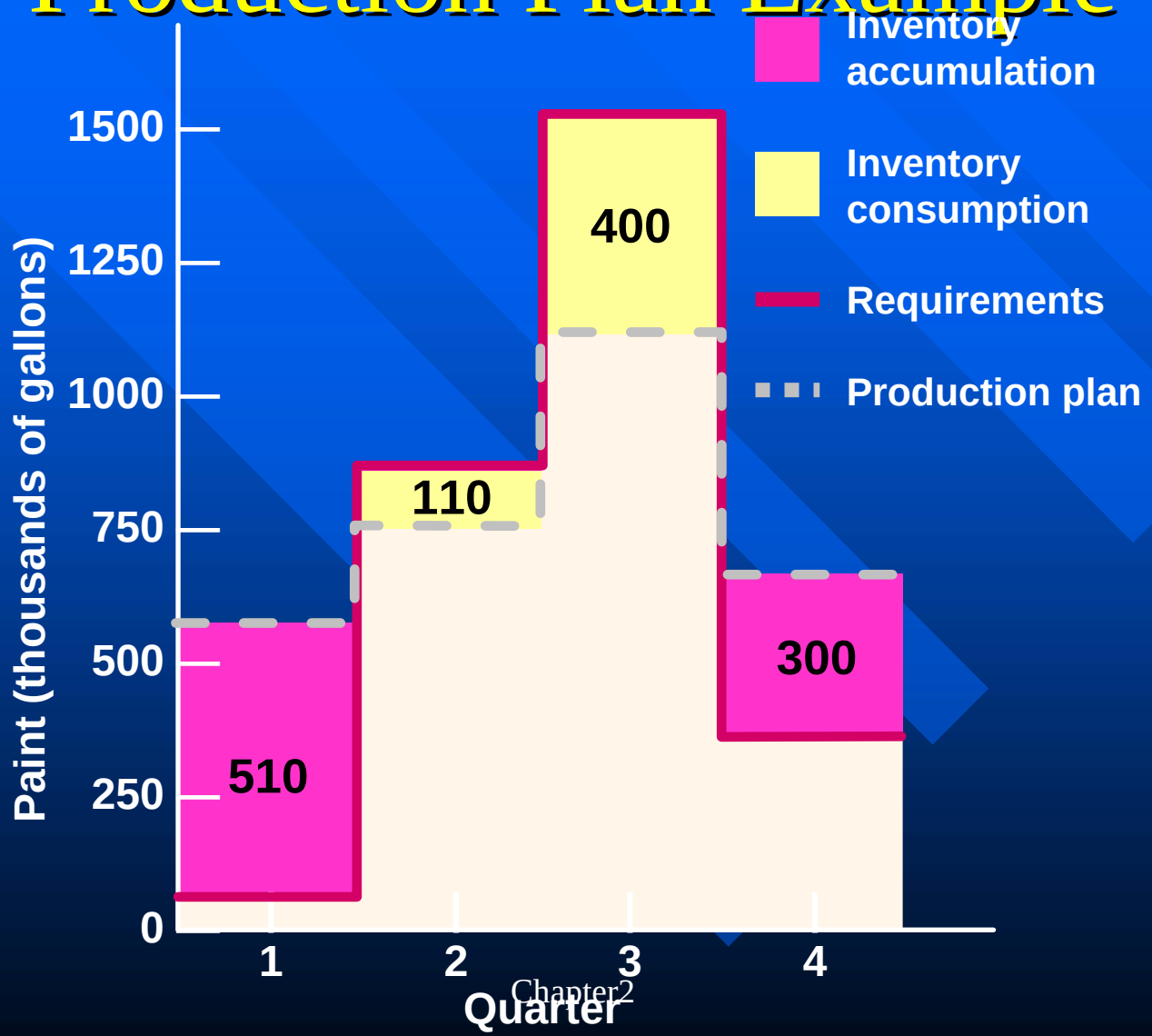
Aggregate Planning Example
Which Plan is Cheaper?

Level Capacity	Chase
$249,100.00	$260,411.00

Clearly, the level capacity plan is cheaper over the selected time horizon

Note: Be cautious in using the chase strategy as many intangibles, such as employee loyalty and commitment to the organization are adversely affected

Production Plan Example



Staffing Strategies in Services: Level Strategy

Tutor 14.4 - Staffing Strategies with Spreadsheets (4 periods)

Enter data in yellow-shaded areas.

Starting workforce	40	Regular-time hrs per worker	600
Regular-time wages (per worker per quarter)	$6,000	Max overtime hrs per worker	100
		Overtime rate ($/hour)	$15
☑ Employees paid for undertime		Cost to hire one worker	$8,000
		Cost to lay off one worker	$2,000
Level Strategy			
Required staff level	43		

	Quarter				
	1	2	3	4	Total
Requirement (hrs)	21,000	18,000	30,000	12,000	81000
Workforce level (workers)	43	43	43	43	172
Undertime (hours)	4,800	7,800	0	13,800	26400
Overtime (hours)	0	0	4,200	0	4200
Productive time (hours)	21,000	18,000	25,800	12,000	76800
Hires (workers)	3	0	0	0	3
Layoffs (workers)	0	0	0	0	0
Costs					
Productive time	$210,000	$180,000	$258,000	$120,000	$768,000
Undertime	48,000	78,000	0	138,000	264,000
Overtime	0	0	63,000	0	63,000
Hires	24,000	0	0	0	24,000
Layoffs	0	0	0	0	0
Total Cost					$1,119,000

Staffing Strategies in Services: Chase Strategy

Tutor 14.4 - Staffing Strategies with Spreadsheets (4 periods)

Enter data in yellow-shaded areas.

Starting workforce	40	Regular-time hrs per worker	600
Regular-time wages (per worker per quarter)	$6,000	Max overtime hrs per worker	100
		Overtime rate ($/hour)	$15
☑ Employees paid for undertime		Cost to hire one worker	$8,000
Chase Strategy		Cost to lay off one worker	$2,000
Required staff level	---		

	Quarter				
	1	2	3	4	Total
Requirement (hrs)	21,000	18,000	30,000	12,000	81,000
Workforce level (workers)	35	30	50	20	135
Undertime (hours)	0	0	0	0	0
Overtime (hours)	0	0	0	0	0
Productive time (hours)	21,000	18,000	30,000	12,000	81,000
Hires (workers)	0	0	20	0	20
Layoffs (workers)	5	5	0	30	40
Costs					
Productive time	$210,000	$180,000	$300,000	$120,000	$810,000
Undertime	0	0	0	0	0
Overtime	0	0	0	0	0
Hires	0	0	160,000	0	160,000
Layoffs	10,000	10,000	0	60,000	80,000
Total Cost					$1,050,000

Aggregate Planning Example via Excel

Solver - Aggregate Planning with Spreadsheets

Enter data in yellow-shaded areas.

☑ Employees Paid for Undertime

	1	2	3	4	Total
Requirement	35	30	50	20	135
Workforce level	35	35	43	30	143
Undertime	0	5	0	10	15
Overtime	0	0	7	0	7
Productive time	35	30	43	20	128
Hires	0	0	8	0	8
Layoffs	5	0	0	13	18

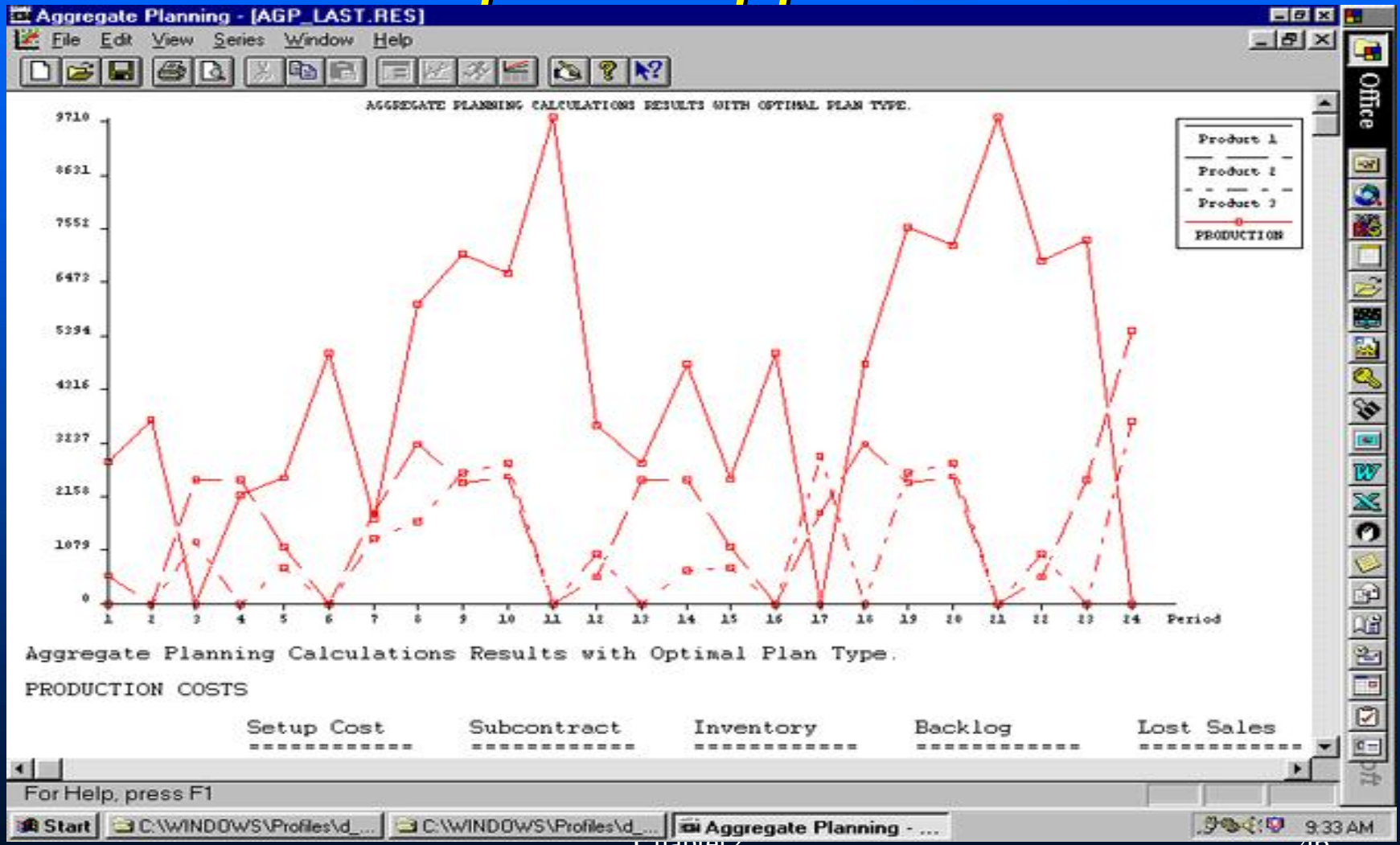
Costs	1	2	3	4	Totals
Productive time	$210,000	180,000	258,000	120,000	$768,000
Undertime	$0	30,000	0	60,000	$90,000
Overtime	$0	0	63,000	0	$63,000
Hires	$0	0	64,000	0	$64,000
Layoffs	$10,000	0	0	26,000	$36,000
Total cost	$220,000	210,000	385,000	206,000	$1,021,000

Aggregate Planning Example via LP

Alternatives		Time Period						Unused Capacity	Total Capacity
		1	2	3	4	5	6		
Period	I_0	0 2	60	120	180	240	300	0	2
1	R_1	1,000 48	1,060	1,120 17	1,180	1,240	1,300	0	65
	R_1	1,150	1,210	1,270	1,330	1,390	1,450	13	13
	S_1	1,250	1,310	1,370	1,430	1,490	1,550	10	10
2	R_2	99,999	1,000 60	1,060 5	1,120	1,180	1,240	0	65
	O_2	99,999	1,150	1,210	1,270 4	1,330	1,390	9	13
	S_2	99,999	1,250	1,310	1,370	1,430	1,490	10	10
3	R_3	99,999	99,999	1,000 65	1,060	1,120	1,180	0	65
	O_3	99,999	99,999	1,150 3	1,210 10	1,270	1,330	0	13
	S_3	99,999	99,999	1,250	1,310	1,370	1,430	10	10
4	R_4	99,999	99,999	99,999	1,000 80	1,060	1,120	0	80
	R_4	99,999	99,999	99,999	1,150 16	1,210	1,270	0	16
	S_4	99,999	99,999	99,999	1,250 10	1,310	1,370	0	10
5	R_5	99,999	99,999	99,999	99,999	1,000 70	1,060	10	80
	O_5	99,999	99,999	99,999	99,999	1,150	1,210	16	16
	S_5	99,999	99,999	99,999	99,999	1,250	1,310	10	10
6	R_6	99,999	99,999	99,999	99,999	99,999	1,000 44	21	65
	O_6	99,999	99,999	99,999	99,999	99,999	1,150	13	13
	S_6	99,999	99,999	99,999	99,999	99,999	1,250	10	10
D		50	60	90	120	70	44	132	566

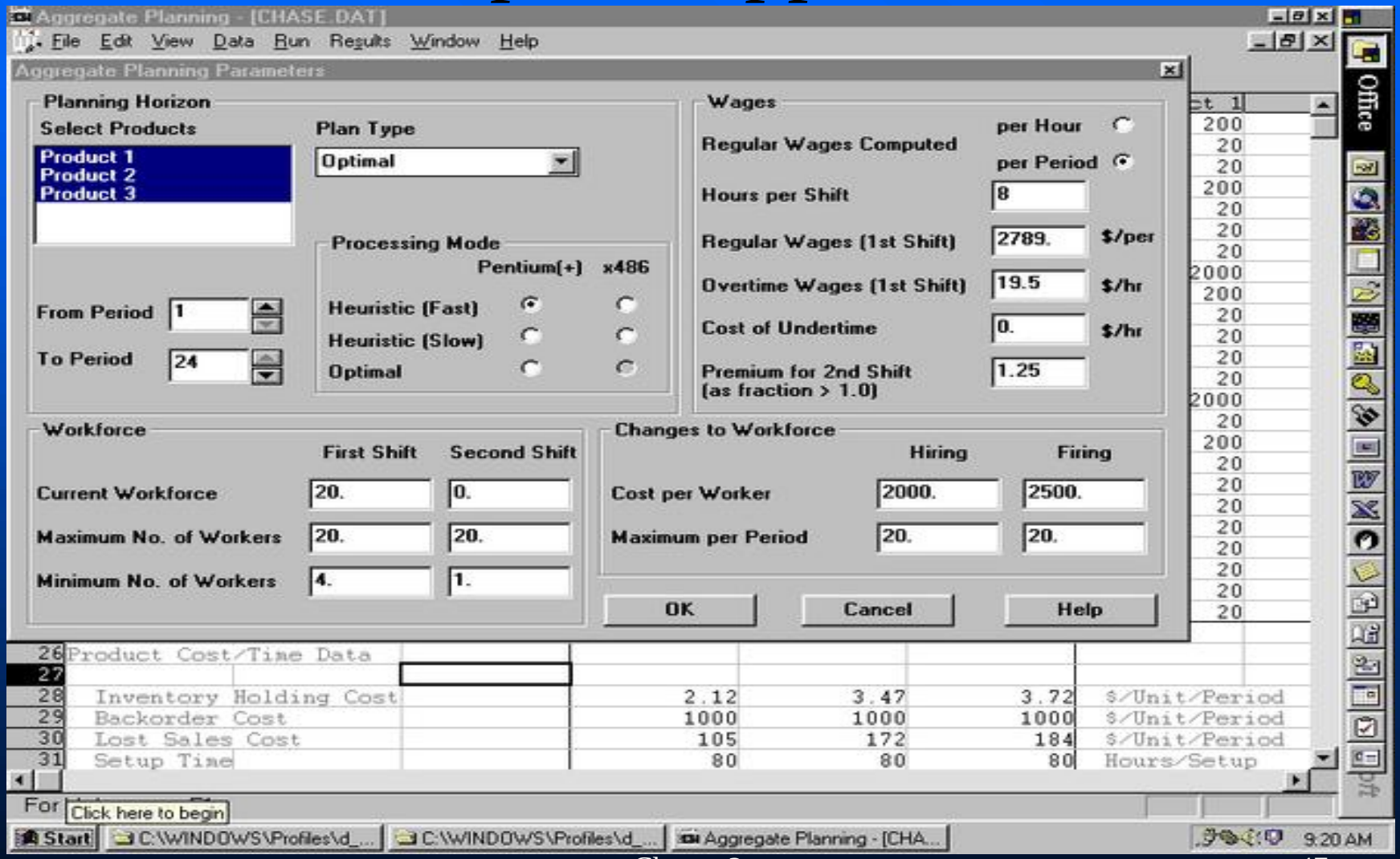
Aggregate Planning Example

Computer Application

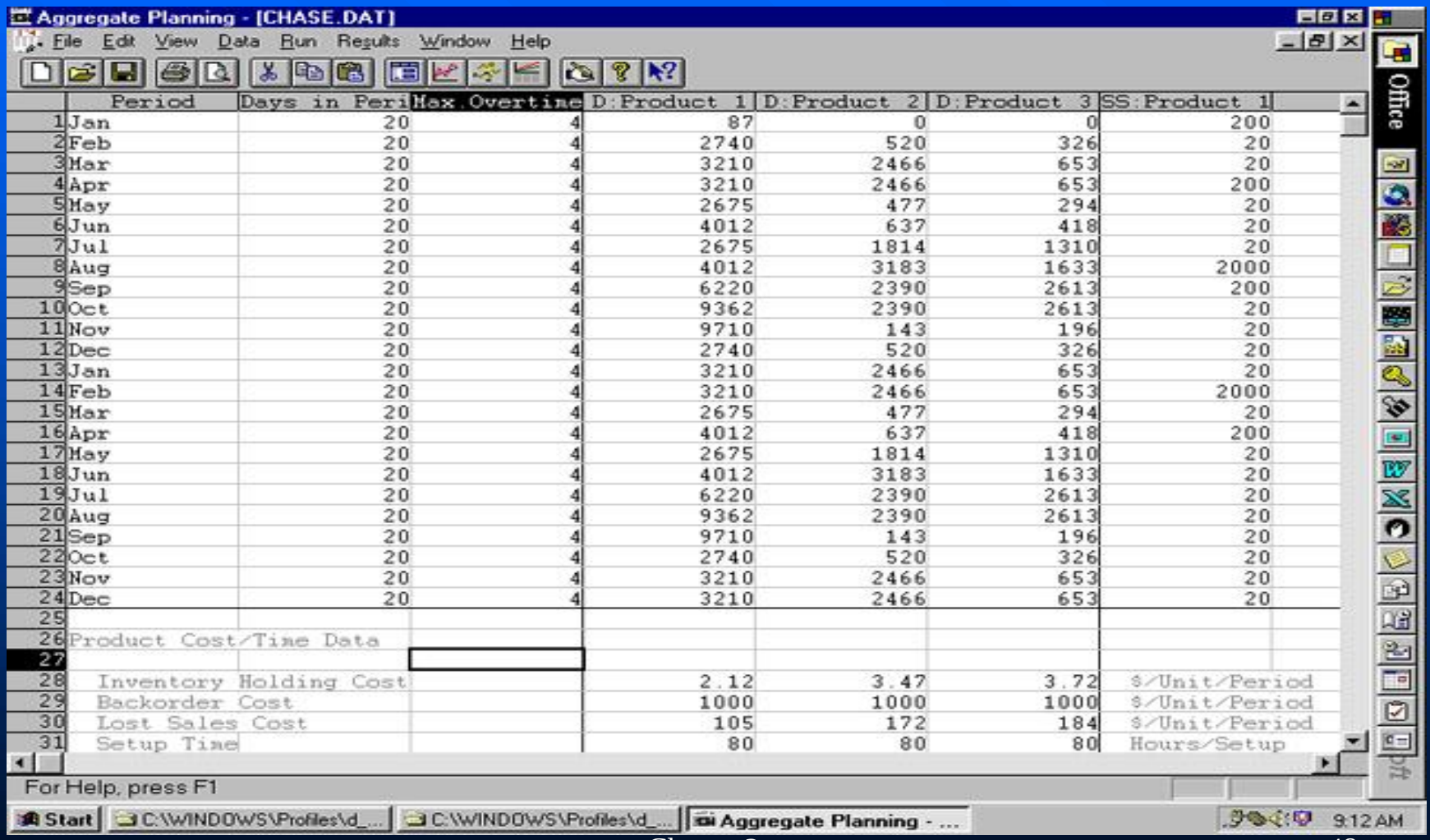


Aggregate Planning Example

Computer Application

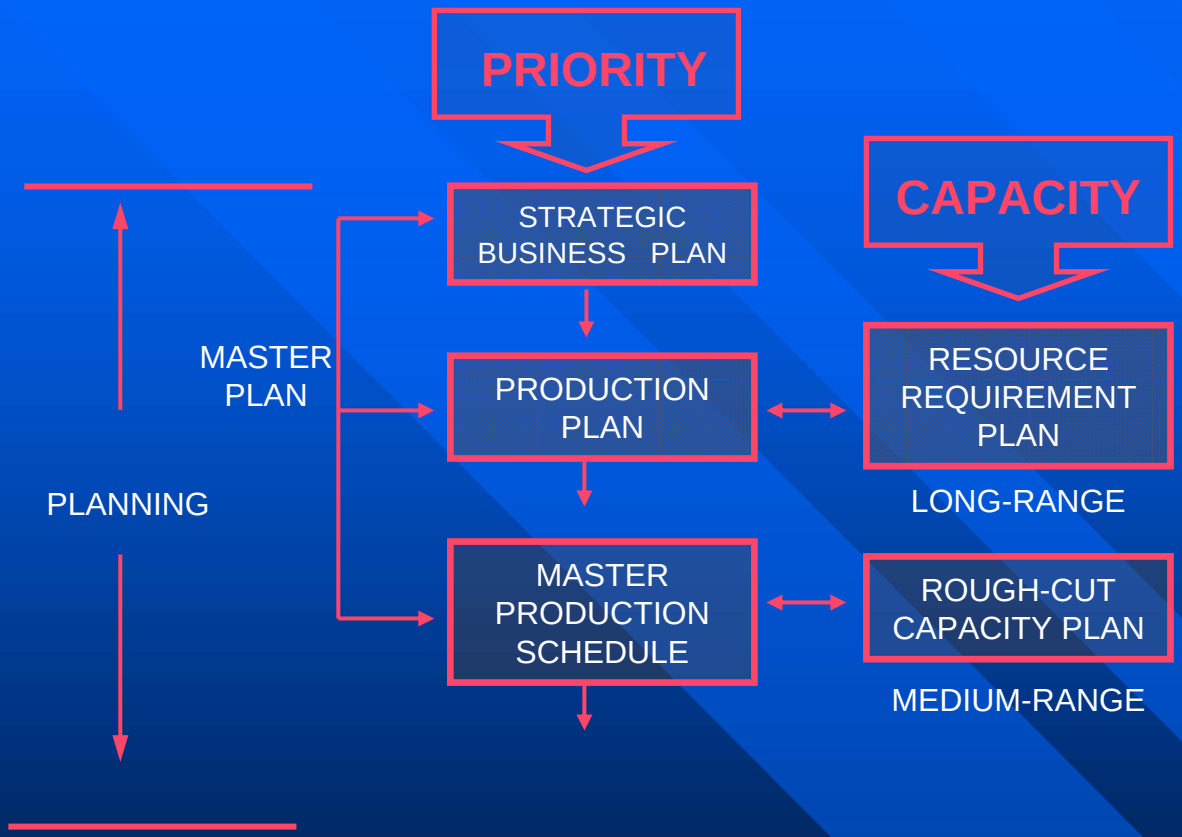


Aggregate Planning Example



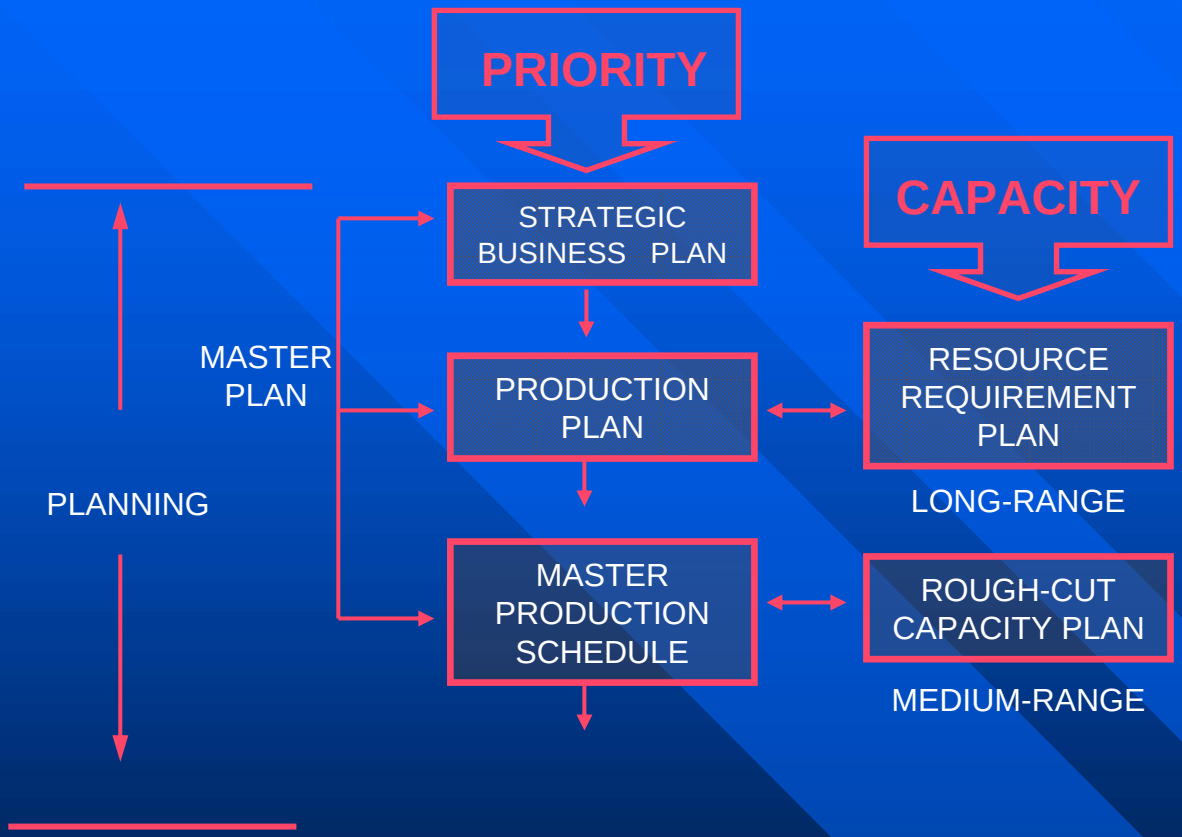
	Period	Days in Peri	Max.Overtime	D:Product 1	D:Product 2	D:Product 3	SS:Product 1	
1	Jan	20	4	87	0	0	200	
2	Feb	20	4	2740	520	326	20	
3	Mar	20	4	3210	2466	653	20	
4	Apr	20	4	3210	2466	653	200	
5	May	20	4	2675	477	294	20	
6	Jun	20	4	4012	637	418	20	
7	Jul	20	4	2675	1814	1310	20	
8	Aug	20	4	4012	3183	1633	2000	
9	Sep	20	4	6220	2390	2613	200	
10	Oct	20	4	9362	2390	2613	20	
11	Nov	20	4	9710	143	196	20	
12	Dec	20	4	2740	520	326	20	
13	Jan	20	4	3210	2466	653	20	
14	Feb	20	4	3210	2466	653	2000	
15	Mar	20	4	2675	477	294	20	
16	Apr	20	4	4012	637	418	200	
17	May	20	4	2675	1814	1310	20	
18	Jun	20	4	4012	3183	1633	20	
19	Jul	20	4	6220	2390	2613	20	
20	Aug	20	4	9362	2390	2613	20	
21	Sep	20	4	9710	143	196	20	
22	Oct	20	4	2740	520	326	20	
23	Nov	20	4	3210	2466	653	20	
24	Dec	20	4	3210	2466	653	20	
25								
26	Product Cost/Time Data							
27								
28	Inventory Holding Cost			2.12	3.47	3.72	$/Unit/Period	
29	Backorder Cost			1000	1000	1000	$/Unit/Period	
30	Lost Sales Cost			105	172	184	$/Unit/Period	
31	Setup Time			80	80	80	Hours/Setup	

MASTER PRODUCTION SCHEDULING



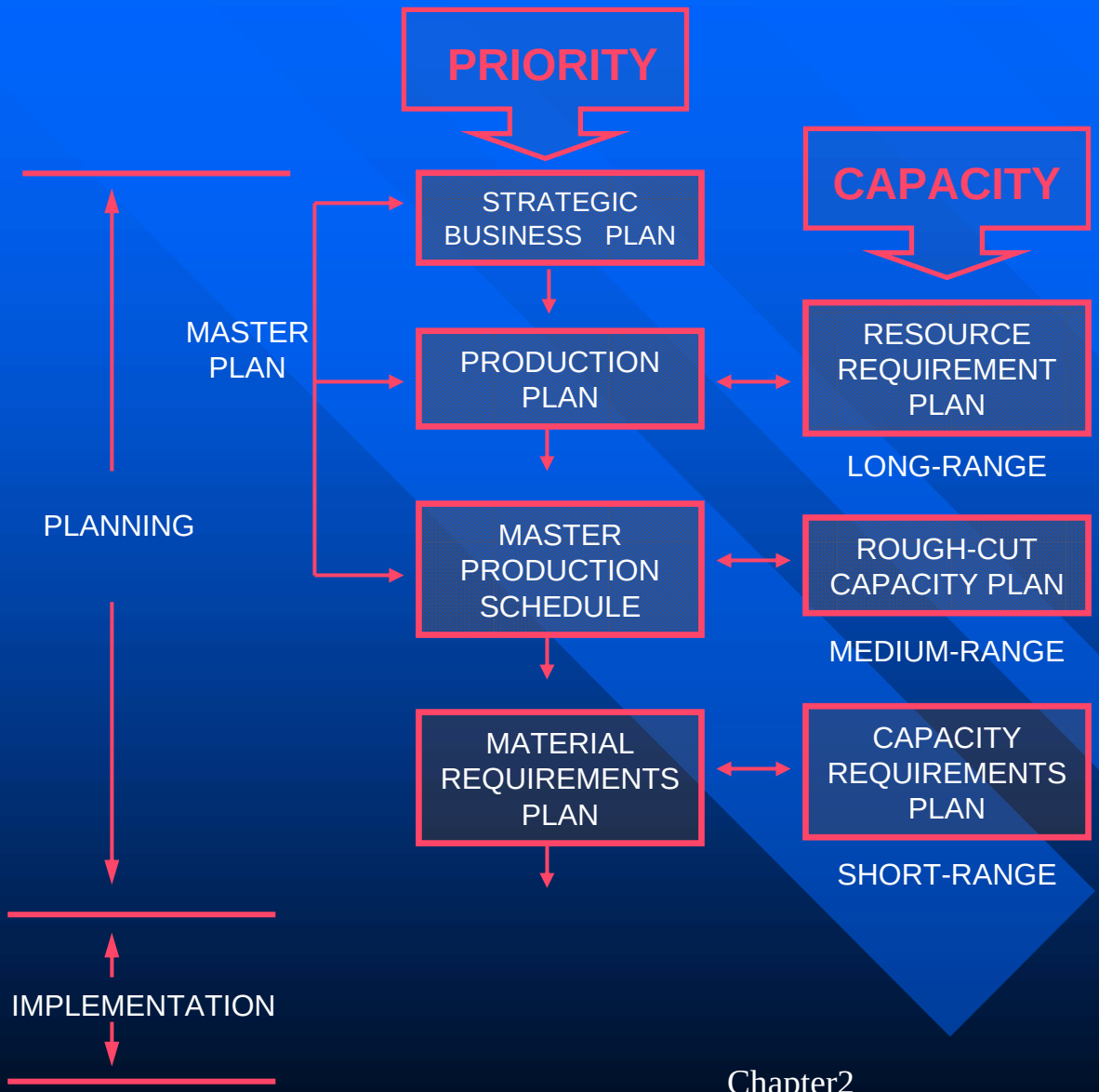
- Is constraint by and supports the production plan
- Development of anticipated build schedules for specific products
- Mix, no volume
- Projected inventory levels
- Projected backlog levels
- Available to promise
- Order promising information
- “Disaggregates” the production plan

MASTER PRODUCTION SCHEDULING



- Provide a realistic schedule
- Maintain desired level of customer service
- Make best use of resources
- Avoid backorders
- To make the best use of material, labor, and equipment
- Key input to purchasing
- *Product launch*

MASTER REQUIREMENT PLANNING



- Constraint by the master production schedule
- To determine the materials required
  - What is required
  - How much is required
  - When it is required
- To establish and maintain priorities
- To avoid production stoppages
- Drive the purchasing process

Guidelines For master Scheduling

1. Work from an aggregate Production plan
2. Schedule common Modules when possible
3. Load facilities realistically
4. Release orders on timely basis
5. Monitor inventory levels Closely
6. Reschedule as required

Guidelines For master Scheduling

Symptoms of a poorly designed MPS

1. Overloaded facilities
2. Under loaded facilities
3. Excessive inventory levels on some end items and frequent stock outs on others
4. Unrealistic schedules that production personnoel do not follow
5. Excessive expediting or follow up

Solved problems

Problem 1

A firm has 4 work centers ,a,b,c,d in series with individual capacities in units per day shown in figure below. The actual output is also shown in the figure

1 What is systems capacity ?

2 What is systems efficiency ?

Solved problems

Solution

System capacity is the capacity of bottleneck center(i.e. center having minimum capacity)

1. System capacity=350 units/day
2. System efficiency = $\frac{\text{Actual Output}}{\text{System capacity}}$

$$=310/350$$

$$=88.57\%$$

Problem 2

A work center operates 5 days a week on a 2 shifts per day basis each shift of 8 hours duration .

There are five machines of the same capacity in this work center.

What is rated output in standard hours per week ?

Solved problems

Solution

Rated capacity =(No of Machines)*(M/c hrs)* (percentage)* (System
per week per week of utilization) Efficiency)

Rated capacity = (5)*(8*2*5)*(0.80)*(0.90)
Per week =288 Standard hours

Q3 The following is a tentative master schedule for four weeks

Product	Week1	Week2	Week3	Week4
A	3000	4000	1200	2500
B	2000	1500	3000	3500
C	1200	1800	2500	2000

Solved problems

The Bill of labor in key work centers for companies
3 major products is as follows
Determine the Load on department X,Y,Z over next 4 weeks

Department	Product A Hrs	Product B Hrs	Product C
X	0.20	0.05	0.10
Y	0.08	0.15	0.20
Z	0.11	0.08	0.05

Solved problems

Calculation of load on department "X"

For week1: (3000*0.20)+(2000*0.65)+(1200*0.10)
= 600+100+120=820 Hrs
For week2: (4000*0.20)+(1500*0.05)+(1800*0.10)
= 800+75+180=1055 Hrs.
For week3: (1200*0.20)+(3000*0.05)+(2500*0.10)
= 240+150+250=640 Hrs.
For week4: (2500*0.20)+(3500*0.05)+(2000*0.10)
= 500+175+200=875 Hrs.

Solved problems

Similar calculation of Y & Z Calculation of load are carried out.

Department Y

Week1…… 780 Hrs

Week2…… 905 Hrs

Week3……1046 Hrs

Week4……1125 Hrs

Department Z

Week1…… 550 Hrs

Week2…… 650 Hrs

Week3……497 Hrs

Week4……655 Hrs

Solved problems

Problem4: A firm produces two products P & Q on a produce to stock basis.The demand for the products come from several sources.The estimated demand for the product for the two products over next 5 weeks are given below.

Sources of Demand	**Product P**					**Product Q**				
	Week					Week				
	1	2	3	4	5	1	2	3	4	5
Intra company orders	-	-	20	10	10	-	-			10
Warehouse orders	-	20	-	-	-	-	-	-	20	-
R&D orders	-	10	10	-	-	-	-	-	10	10
Customer demand	25	25	20	25	20	30	30	25	25	20

Solved problems

The safety stock for the products P is 25 and for Q is 30 .The lot size for P is 60 and for Q is 70.The beginning inventory for P is 50 and for Q is 60.Prepare a master production schedule

Product	**Data**					
"P" (lot size=60) (Safety Stock =25)		Week				
		1	**2**	3	4	5
	Total Demand	25	55	50	35	30
	Beginning Inventory	50	25	30	40	65
	Required production	-	60	60	60	-
	Ending Inventory	25	30	40	65	35

Solved problems

Product	**Data**					
"Q" (lot size=70) (Safety Stock =30)		Week				
		1	**2**	3	4	5
	Total Demand	30	30	35	55	40
	Beginning Inventory	60	30	70	35	50
	Required production	-	70	-	70	70
	Ending Inventory	30	70	35	50	80

Aggregate Planning
& Master Production Scheduling

End Of

Chapter 2