TEK 421 exam March 2020 - Answers

Problem 1

Question1

a)

Levelled	1	2	3	4	Total	Cost
Forecast	1000	3000	4500	1500	10000	
Producion	2000	2000	2000	2000	8000	6000000
Overtime	400	400	400	400	1600	1520000
Inv. (400)	1800	1200	0	0		
Av. Inv.	1100	1500	600	0	3200	160000
Backlog	0	0	900	0	900	450000
Total						8130000

Chase	1	2	3	4	Total	Cost
Forecast	1000	3000	4500	1500	10000	
Producion	600	2000	2000	2000	6600	4950000
Overtime	0	1000	2000	0	3000	2850000
Inv. (400)	0	0	0	0		
Av. Inv.	200	0	0	0	200	10000
Backlog	0	0	500	0	500	250000
Total						8060000

Levelled	1	2	3	4	Total	Cost
Forecast	1000	3000	4500	1500	10000	
Producion	2000	2000	2000	2000	8000	6000000
Subcon.			1600		1600	1680000
Inv. (400)	1400	400	0	0		
Av. Inv.	900	900	200	0	2000	100000
Backlog	0	0	500	0	500	250000
Total						8030000

Chase	1	2	3	4	Total	Cost
Forecast	1000	3000	4500	1500	10000	
Producion	600	2000	2000	1500	6100	4575000
Subcon	0	1000	2500	0	3500	3675000
Inv. (400)	0	0	0	0		
Av. Inv.	200	0	0	0	200	10000
Backlog	0	0	0	0	0	0
Total						8260000

b)

	1	2	3	4	Total	ME	MAD
Forecast	1000	3000	4500	1500	10000		
Demand	1198	2942	5116	1744	11000		
FE	-198	58	-616	-244	-1000	-250	
|FE|	198	58	616	244	1116		279

c)

α = 2 / 4 = 0.5
Demand for Q4 (without seasonal consideration) = 1744 / 0.7 = 2491
Forecast for Q4 (without seasonal consideration) = 1500 / 0.7 = 2143
Basic forecast for Q1 (without seasonal consideration) = 0.5 x 2491 + 0.5 x 2143 = 2317
Forecast for Q1 (with seasonal consideration) = 2317 x 0.5 = 1159 units

Problem 2

a)

	1	2	3	4	5	6
Item B	1000			1000		1000
Item D	800	800			800	
Gross req.	1800	800	0	1000	800	1000
Sch. Rec.	1500					
Stock on hand (800)	500	1200	1200	1700	900	1400
POR		1500		1500		1500
POS	1500		1500		1500	

b)

60 + 1500 x 4 = 101h in week 1, 3 and 5

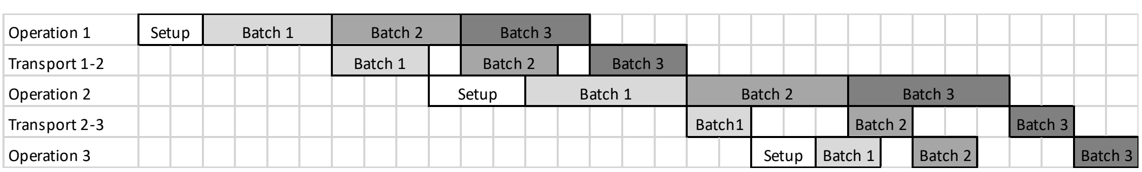
c)

Normal throughput time = 60 + 4X + 90 + 90 + 5X + 60 + 60 + 2X = 360 + 11X

Adjusted throughput time = 60 + 4X/3 + 90 + 90 + 5X + 60 + 2X/3 = 300 + 7X

360 + 11X – 300 – 7X = 60 + 4X = 180

4X = 120 -> X = 30



Problem 3

a)

EOQ		**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**No.**
Requirement		710	960	520	650	860	740	840	720	
Inventory	(1500)	790	1410	890	240	960	220	960	240	
Planned order receipt			1580			1580		1580		3

ERT		**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**No.**
Requirement		710	960	520	650	860	740	840	720	
Inventory	(1500)	790	720	150	1010	150	990	150	150	
Planned order receipt			840		1510		1580		720	4

b)

Week		**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Forecast		100	100	**100**	100	**100**	**100**	**100**	**100**
Actual orders		**120**	**75**	80	**115**	95	70	55	40
Projected inventory	(180)	60	285	185	70	270	170	70	270
Master production schedule			300			300			300
Available to promise		60	30			80			260
Order 1: Yes		60	30			10			260
Order 2: Yes		50				10			260
Order 3: No		50				10			260
Order 4: Yes (after planning time fence)									

c)

σ_{DDLT} = Square root (2 x (1.25 x 40)^2 + 0.5^2 x (10 000 / 50)^2) = 122

E(z) = (1 – 0.95) x Q / σ_{DDLT} = 0.05 x 500 / 122 = 0.2049 -> < = 1.66

SS = 122 x 1.66 = 203 units

Problem 4

The answers should suggest and motivate different actions:

1. This answer should focus on reducing the causes: Reduce purchasing and manufacturing order quantities. Differentiating safety stocks. Implement VMI where the supplier owns the inventory. Apply more of a chase strategy.
2. This answer should focus on short- and long-term effects: Basically order quantities should be reduced by first reducing ordering costs and set up costs. Also when reducing order quantities the safety stocks should be increased to maintain current service levels.
3. The consequences will be an increased number of orders and increased total ordering cost as well as reduced available capacity due to increased set-up time. The service level will decrease. Labor cost will increase.

Problem 5

This answer is first expected to describe the specific S&OP context in ETO environments. Important issues here are to describe ETO related demand and supply uncertainties (focusing on medium-term uncertainties which can be planned in the S&OP). Demand uncertainties to discuss include the lumpiness that can be generated by large orders in the order bidding process, the uncertainty related to late order confirmations of unique product configurations, the types of product configurations and ‘degree’ of engineering requirements and uniqueness of products. On the supply side the extent and variety of required engineering and production preparation for different products affect the supply uncertainty. Also the extent of need of unique and rare resources (e.g. specific engineering or project management competence) for different products generates supply uncertainty. The uniqueness, volume, frequency and leadtimes of products and flows affect both demand and supply uncertainty and the overall S&OP set-up.

When the specific S&OP context is described, then these context issues/uncertainties are expected to be related to the S&OP process. This discussion can include relating/integrating the S&OP process with other planning processes, especially the order bidding process to make sure the ‘right’ orders (from a demand-supply balancing perspective) is prioritized in the bidding, and the engineering resource planning (i.e. the long-term planning of engineering/human resources). Then the answer could discuss S&OP activities by activities and/or discussing S&OP from a mechanism perspective (e.g. parameters, organization, IT, measurement, etc. as in Grimson and Pyke). Issues related to the demand uncertainty and demand planning side of S&OP relate to what orders and product configurations to be produced. This should be assessed and communicated (as assumptions, scenarios, etc.). On the supply side, a focus needs to be on critical engineering resources – using demand uncertainties as input. There are differences between ETO businesses. Some require new innovations and have low product volume and long lead times, while others require minor engineering modifications and have quite high product volumes and shorter lead times. The later can configure an S&OP very much like most ‘traditional’ manufacturers, while the former may not be able to conduct quantitative forecasting and may be able to run a process less frequently than monthly. Different types of discussions could be made related to different types of ETO and how they may require different S&OP designs.

Problem 6 *(the max points on this question was changed from 10 to 5p.. The max point of the exam was then changed from 68 to 63p. Everyone's total exam point has thereafter been calculated as 'your points x 68/63)*

(a) strengths: There are not so many strengths related to MPS process but the cross-functional involvement is an issue to bring up.

(a) weaknesses: Three main weaknesses are directly related to the MPS:

1. Since capacity requirements per unit when using capacity bills is put in the same period as when the end product is supposed to be finished and the manufacturing lead times at Mechanical Fixes are several weeks long, the capacity requirements calculated from the master production schedule will for some of the work centers be accounted for several weeks later than they will be present in reality. For products with seasonal demand this will imply that peaks in capacity requirements will be shown too late when approaching high seasons and too early when approaching low seasons. 2p

2. Calculating capacity requirements from a master production schedule expressed as quantities planned to be finished per week means that no consideration is taken to stock on hand of finished products or semi-finished items. The basic assumption is that stock on hand at the end of the planning horizon will be the same as it is when the planning is carried out. This decreases the reliability of the capacity requirements calculated from the master production schedule since it for example means that no consideration is taken to seasonal inventories build up to cover some of the demand during the high season. 1p

3. Calculating capacity requirements based on estimated demand per week results in capacity requirements that will be much smoother than if the calculation is based on generated manufacturing orders. The calculated capacity requirements will also be much smoother than the real capacity requirements since these requirements are based on manufacturing orders as well. This is especially the case at Mechanical Fixes since the company's lot sizes are comparatively big. 2p

(b) What to change and effect: This answer should be related to the identified weaknesses and could include (1) Change to capacity profiles with lead time off-setting, (2) Change to CRP, (3) Calculate the capacity need from the MPS instead.

Problem 7

General supplementary recommendations – applicable regardless of which other methods are chosen:

Standardise and reduce setup times. Since the setup times vary, it should be possible to aim for the setup times that are the shortest today – at least. That would make it possible to reduce batch sizes and reduce the buffer between the workshops.

Reduce finished goods inventory. Because long lead times are acceptable, and because capacity seems not to constitute any restriction, it is not necessary to have a large finished goods inventory – regardless of whether pull or push is used in the final assembly. This is also facilitated by the standardisation and reduction of setup times, as these actions will make the throughput times more predictable.

Suggested solutions for the machining workshop

Traditional, centralised control:

Order release control. (Several options accepted, assuming some logic provided.)

- Regulated order release. Would be possible to apply. However, in the current case there is little need to use this relatively complex method, as capacity is not a restriction.
- Input/output control. Would be difficult to apply here, as the flows are not serial. Could be an option if the machining workshop could be rearranged into a cell layout, which would then be a supplementary activity.
- Order release from planned start times seems to be applicable. A supplementary activity could be to make sure that the workload is smooth so that the predictability of throughput times is high. Since the customers accept long lead times, it is possible to distribute the planned start times of the orders over time.

Priority control. (Several options accepted, assuming some logic provided.)

- The priority rule of largest order value could be applied. Focuses on tied-up capital.
- Shortest operation time rule may also be applicable. This method too focuses on keeping tied-up capital low.
- Supervisor-managed may also be applicable. Relatively simple workshop. However, priority will not be attached to tied-up capital.

Pull-based control:

Order release.
Kanban could be applied, even though the setting of a functional workshop is not optimal. Buffers of all relevant component types need to be placed before and after each operation. When consumption occurs, a kanban is sent to the preceding process for the respective component.

Priority control.
A kanban board at each station to manage priorities between different orders.

Suggested solutions for the final assembly

Traditional:

Order release (Several options accepted, assuming some logic provided.)

- Input/output control a feasible option. It is a simple way of controlling the order release to an assembly line.
- Order release from planned start dates also feasible, given the relatively simple and predictable assembly processes. (Here, the predictability depends on the stardardisation and reduction of setup times.)

Priority control
FIFO is simple and the default solution at an assembly line.

Pull-based:

Order release & priority control: kanban. FIFO flows are natural in a line layout, which suits kanban well.