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Review of the Exam 14-01-14

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KPP227 - 2014

KPP227 2014 1

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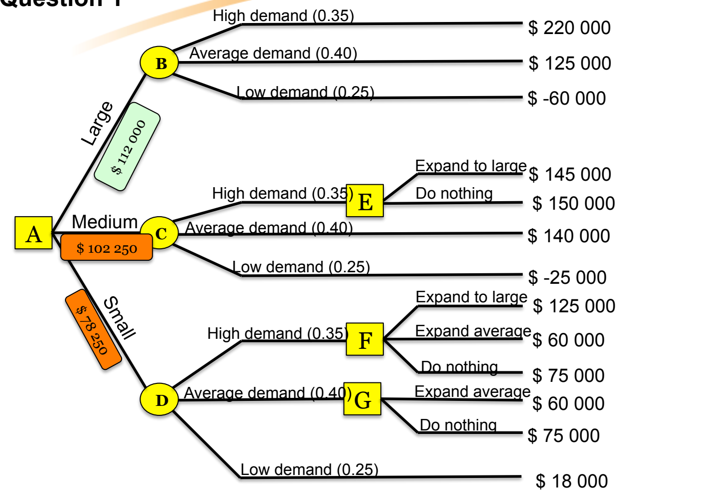
Question 1



Event B: 0.35x220000 + 0.40x125000 – 0.25x60000 = 112000
Event C: 0.35x150000 + 0.40x140000 – 0.25x25000 = 102250
Event D: 0.35x125000 + 0.40x75000 + 0.25x18000 = 78250
Therefore, the best decision would be to build a large facility, with an expected payoff of $112000

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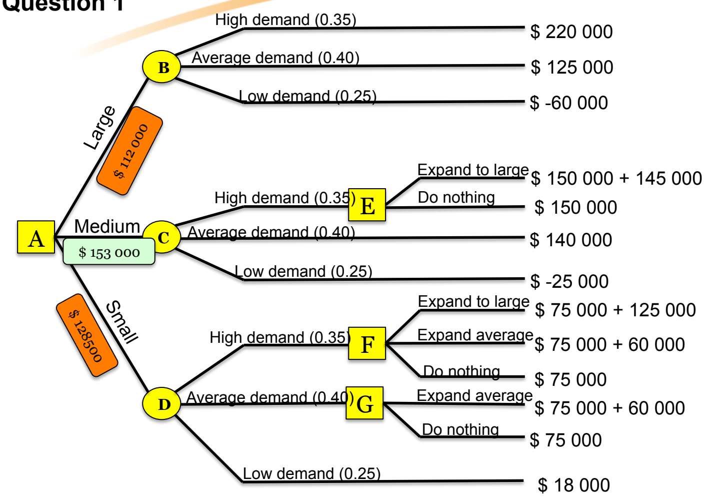
Alternative interpretation of the text

Question 1



Event B: 0.35x220000 + 0.40x125000 – 0.25x60000 = 112000
Event C: 0.35x(150000 + 145000) + 0.40x140000 – 0.25x25000 = 153000
Event D: 0.35x (75000 + 125000) + 0.40x75000 + 60000 + 0.25x18000 = 128500
Therefore, the best decision would be to build a medium facility, with an expected payoff of $153000

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Question 2

μ = 5,   λ = 3

$$L_q = \rho L = \frac{3^2}{5(5-3)} = 0.9\ products$$

$$L = \frac{3}{5-3} = 1.5\ products$$

- The queue will have an average of 0.9 products, which means that room for one product should be enough. In other words, 1.5 m² floor space should be required.
- The average value of products in the testing system would be 1.5 x 1400 = 2100 €

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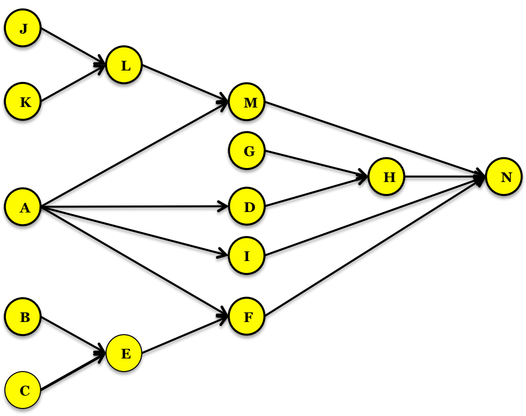
Question 3



b) CT = (450x60) / 270 = 100s/unit.

c) Total process time = 485s. 485/100 = 4.85, which means that at least 5 stations are required.

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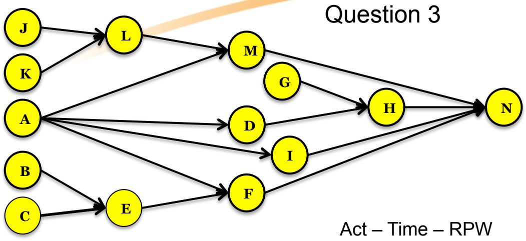
Question 3



Act	Time	RPW
A	10	245
B	25	195
C	10	180
D	35	125
E	65	170
F	35	105
G	30	120
H	20	90
I	45	115
J	50	190
K	20	160
L	40	140
M	30	100
N	70	70

Station	Element	Cumulative time	Slack
S1	A	10	
	B	35	
	J	85	
	C	95	5
S2	E	65	
	D	100	0
S3	K	20	
	L	60	
	F	95	5
S4	G	30	
	I	75	
	H	95	5
S5	M	30	
	N	100	0

d) Efficiency

485/5x100 = 97%

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Question 4

$$\text{ELS} = \sqrt{\frac{2DS}{H}}\sqrt{\frac{p}{p-d}} = \sqrt{\frac{2\times 10500\times 200}{0.21}}\sqrt{\frac{190}{190-30}} = 4873.4\ barrels$$

$$\text{C} = \frac{Q}{2}\left(\frac{p-d}{p}\right)H + \frac{D}{Q}S = \frac{4873.4}{2}\left(\frac{190-30}{190}\right)0.21 + \frac{10500}{4873.4}200 = \$861.82$$

$$TBO_{ELS} = \frac{ELS}{D}350(days/year) = \frac{4873.4}{10500}350 = 162.4 \approx 162\ days$$

$$t_P = \frac{ELS}{P} = \frac{4873.4}{190} = 25.6 \approx 26\ days$$

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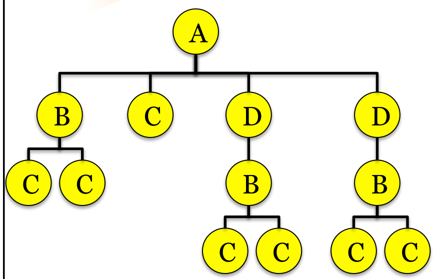
Question 5



MRP

Item: A	Week:	1	2	3	4	5	6	7	8
	Due:								250
	Release:						250		

Item:	Week:	1	2	3	4	5	6	7	8
	Due:								
	Release:								

Item: **D** — Lot size: L4L; Lead time: 3 weeks; Safety stock: 0 units

Week:		1	2	3	4	5	6	7	8
Gross requirements							500		
Scheduled reciepts									
Projected on hand	0	0	0	0	0	0	0	0	0
Planned reciepts							500		
Planned order releases				500					

Item: **B** — Lot size: L4L; Lead time: 2 weeks; Safety stock: 0

Week:		1	2	3	4	5	6	7	8
Gross requirements				500			250		
Scheduled reciepts									
Projected on hand	0	0	0	0	0	0	0	0	0
Planned reciepts				500			250		
Planned order releases		500			250				

Item: **C** — Lot size: FOQ = 1000; Lead time: 1 week; Safety stock: 100 units

Week:		1	2	3	4	5	6	7	8
Gross requirements		1000			500		250		
Scheduled reciepts		1000							
Projected on hand	200	200	200	200	700	700	450	450	450
Planned reciepts					1000				
Planned order releases				1000					

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Question 6

C \ D	300	200	200	
100	100 [5]	3 [4]	4 [3]	0
300	200 [8]	100 [4]	1 [3]	3
300	-2 [9]	100 [7]	200 [5]	6
	5	1	-1	

C \ D	300	200	200	
100	100 [5]	3 [4]	2 [3]	0
300	100 [8]	200 [4]	-1 [3]	3
300	100 [9]	2 [7]	200 [5]	4
	5	1	1	

C \ D	300	200	200	
100	100 [5]	2 [4]	2 [3]	0
300	1 [8]	200 [4]	100 [3]	2
300	200 [9]	1 [7]	100 [5]	4
	5	2	1	

Total cost: 100x5 + 200x4 + 100x3 + 200x9 + 100x5 = 3900

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Question 7

The steps are the following:
1. Identify the bottlenecks
2. Exploit the bottlenecks
3. Subordinate all other decisions to step 2.
4. Elevate the bottlenecks.
5. Do not let inertia set in.

Further descriptions in the line of the description in the book pp. 266-267 (ed. 10)
Also in the PP Capacity and break-even analysis

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Question 8

Forecasts (α = 0.1):
Q2: 0.1x180 + 0.9x175 = 175.5
Q3: 0.1x168 + 0.9x175.5 = 174.75
Q4: 0.1x159 + 0.9x174.75 = 173.2
Q5: 0.1x175 + 0.9x173.2 = 173.4
Q6 : 0.1x190 + 0.9x173.2 = 174.9
Q7: 0.1x205 + 0.9x174.9 = 177.9
Q8 : 0.1x180 + 0.9x177.9 = 178.1
Q9 : 0.1x182 + 0.9x178.1 = 178.5

Quarter	True demand	Forecast	Error (Abs)	Error^2
1	180	175	5	25
2	168	176	8	64
3	159	175	16	256
4	175	173	2	4
5	190	173	17	289
6	205	175	30	900
7	180	178	2	4
8	182	178	4	16
Total:			84	1558

$$MAD = \frac{\sum|E|}{n} = \frac{84}{8} = 10.5$$

$$MSE \frac{\sum E_t^2}{n} = \frac{1558}{8} = 194.75$$

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Forecasts (α = 0.5):
Q2: 0.5x180 + 0.5x175 = 177.5
Q3: 0.5x168 + 0.5x177.5 = 172.8
Q4: 0.5x159 + 0.5x172.8 = 165.9
Q5: 0.5x175 + 0.5x165.9 = 170.4
Q6 : 0.5x190 + 0.5x170.4 = 180.2
Q7: 0.5x205 + 0.5x180.2 = 192.6
Q8 : 0.5x180 + 0.5x192.6 = 186.3
Q9 : 0.5x182 + 0.5x186.3 = 184.2

Quarter	True demand	Forecast	Error (Abs)	Error^2
1	180	175	5	25
2	168	178	10	100
3	159	173	14	196
4	175	166	9	81
5	190	170	20	400
6	205	180	25	625
7	180	193	13	169
8	182	186	4	16
Total:			100	1612

$$MAD = \frac{\sum|E|}{n} = \frac{100}{8} = 12.5$$

$$MSE \frac{\sum E_t^2}{n} = \frac{1612}{8} = 201.5$$

α = 0.1 gives a smaller MAD, which is better.

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Question 9

Described in PP Inventory management

a) Functions of inventory may be the following:
1. To meet anticipated customer demand
2. To smooth production requirements
3. To buffer between operations
4. To protect against stock-outs
5. To exploit order cycles
6. To hedge against price raises
7. To permit operations (Pipeline inventory)

b) Three reasons for keeping low inventory may be:
1. Avoid bound capital
2. Inventory hides quality problems
3. Inventory requires space
4. Inventory requires handling

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Question 10

$$EOQ = \sqrt{\frac{2DS}{H}} = \sqrt{\frac{2\times 2000\times 20}{0.2\times 2}} = 447.2 \ or \ 447 \ units$$

This is an infeasible solution, since 447 units can't be ordered for €2/unit. Therefore, we calculate the EOQ at the next lowest price €2:25:

$$EOQ = \sqrt{\frac{2DS}{H}} = \sqrt{\frac{2\times 2000\times 20}{0.2\times 2.25}} = 421.6 \ or \ 422 \ units$$

This is a feasible solution. Next, we calculate the total cost at EOQ and at higher discount quantities:

$$C = \frac{Q}{2}(H) + \frac{D}{Q}(S) + PD$$

$$C_{422} = \frac{422}{2}(0.2\times 2.25) + \frac{2000}{422}(20) + 2.25\times 2000 = 4689.74$$

$$C_{1000} = \frac{1000}{2}(0.2\times 2) + \frac{2000}{1000}(20) + 2\times 2000 = 4240$$

The cost for ordering 1000 is the lowest.

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Question 11

Consumer products

Consumer Products are those that are directed to end users.

- ***Convenience Products*** are those goods and services that consumers purchase frequently, immediately, and with limited comparative shopping. Typical products are food.

- ***Shopping Products*** are those for which customers are willing to seek and compare: shopping many locations, comparing price and quality, performance, and making a purchase only after careful deliberation. Typical products are fashion clothes.

- ***Specialty Products*** are those for which buyers are willing to expend a substantial effort and often to wait a significant amount of time in order to require them. Buyers seek out particular types and brands of goods and services. Typical products are custom made automobiles.

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Question 11

Consumer products

	Convenience products	Shopping products	Specialty products
Distribution	**Wide** with many outlets		**Centralized** with few outlets
Logistics costs	**High** but justified by the increased sales potential		**Low** because of limited distribution
Customer service	Product availability and accessibility		**Low** in terms of logistics

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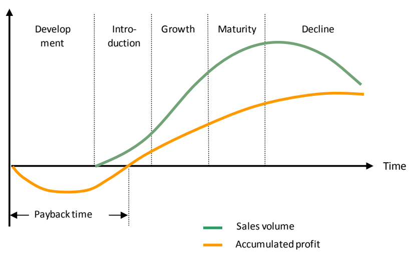
Question 11

Product life cycle (PLC)

The **physical distribution strategy** differs for each stage.

- During the introductory stage, the strategy is a cautious one, with stocking restricted to relatively few locations. Product availability is limited.
- The growth stage may be fairly short
- During the maturity stage, sales growth is slow or stabilized at a peak level. At this time the product has its widest distribution.
- During the decline stage, sales volume declines as a result of technological change, competition, or waning consumer interest.



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Question 11

Product characteristics

- **Weight/Bulk Ratio**: Products with a high density, i.e. have a high weight-bulk ratio show good utilization of transportation equipment and storage facilities. However, for products with low density, the weight capacity of transportation equipment is not fully realized before the bulk carrying limit is reached.
- **Value-Weight Ratio:** Storage costs are particularly sensitive to value. Low product value means low storage cost, but high transportation cost in relation to sales value. The opposite is true for high value products.
- **Risk Characteristics**: When a product shows high risk (e.g. is flammable) more restrictions on the distribution system are needed. Both transport and storage costs are higher.

Cost	Weight/ Bulk		Value/ Weight		Risk	
	High	*Low*	*High*	*Low*	*High*	*Low*
Storage	Low	High	High	Low	High	Low
Transportation	Low	High	Low	High	High	Low

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Question 12

D = 520 u/week
σ_t = 17 units

a) $\sigma_{dLT} = \sqrt{\sigma_d^2 L} = \sigma_d \sqrt{L} = 17\sqrt{7} = 45$ units

b) dL = 520x7 = 3640 units

c) $R = \bar{d}L + Safety\ stock$

Safety stock $= z\sigma_{dLT}$

Service level 99% give Z = 2.33
Safety stock = 2.33 x 45 = 105
R = 3640 + 105 = 3745

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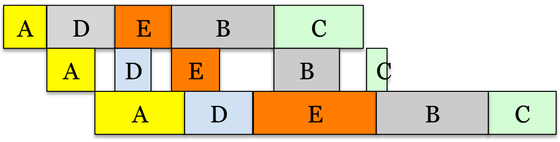
Question 13

min t_{i1} = min $\{t_{11}, t_{21}, t_{31}, t_{41}, t_{51}, t_{61}, \}$ = 12
max t_{i2} = max $\{t_{12}, t_{22}, t_{32}, t_{42}, t_{52}, t_{62}, \}$ = 18
min t_{i3} = min $\{t_{11}, t_{21}, t_{31}, t_{41}, t_{51}, t_{61}, \}$ = 18
Since max t_{i2} = min t_{i3} we may apply Johnson's rule

Job	M' 1	M' 2
A	27	39
B	45	48
C	30	24
D	27	30
E	27	45

Several possible solutions, starting with various orders of A, D, and E, and ending with B, and C.
The Gantt scheme below is based on the order: A, D, E, B, C



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Question 14

$$M = \frac{30000\times 0.6 + \frac{30000}{50}\times 3 + 12000\times 1 + \frac{12000}{30}\times 3}{200\times 16\times 0.85} = 12.13$$

13 machines are necessary

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Question 15

A function of wage rates, training requirements, work attitudes, worker productivity, union strength.
See details on page 408.