



**LISBOA
SCHOOL OF
ECONOMICS &
MANAGEMENT**

Production and Operations Management

Extraordinary Examination Period

June 25, 2014 (Thursday), 3:00 p.m.

NAME _____

CONSULTATION OF ADDITIONAL MATERIAL IS STRICTLY FORBIDDEN. THE EXAM HAS EXACT DURATION OF 2 HOURS AND 30 MINUTES, WITH NO FURTHER TOLERANCE GIVEN.

PLEASE READ THE FOLLOWING INSTRUCTIONS BEFORE STARTING THE EXAM:

1. Leaving the examination room implies the final delivery of this exam. This includes exiting the room to use the sanitary facilities.
2. Please contact your instructor if you decide to forego the evaluation of this exam.
3. This exam has **15** pages. DO NOT UNSTAPLE THEM.
4. **Always write down your name in the specified spaces.**
5. The utilisation of cellular phones, headsets, or electronic devices other than your calculator is strictly forbidden.
6. Additionally, the usage of any feature cellular phone capability, including voice and/or text communication, clock, or calculator is strictly forbidden.
7. At your desk you may only have this exam, a calculator, a pen/pencil and a valid ID with photographic identification.

(I) (2.5 values)

**Please mark the correct answer with an "X" on the shaded column.
A wrong or misplaced answer is considered null.**

[1.0] Consider the following data concerning the orders received from clients by TETRAPAC in the two previous weeks:		
Orders sorted by arrival date	Due date	Processing Time
EC1	250	40
EC2	300	25
EC3	210	5
EC4	220	15
EC5	275	20
Assuming the orders start being processed on day 201 on an EDD sequence, what is the average number of jobs in the system?		
1		5
2		2.6
3		21
4		7
5		20

[0.5] Which of the following process strategies allow for a greater product variety?		
1		Process focus
2		Repetitive process
3		Product focus
4		Modular process
5		None of the above

[0.5] A test performed to 50 components generated the following data describing the time intervals between failures and associated probabilities: 1 week - 10%; 2 weeks - 30%; 3 weeks - 50%; 4 weeks - 10%. The expected number of failures per week is:		
1		19 failures
2		2.6 failures
3		0.4 failures
4		5 failures
5		25 failures

[0.5] An electronic system has sequential 3 components with reliabilities of 0.95, 0.85, and 0.80, respectively. Another system with the same characteristics is added in parallel to the first one. What is the increase in the system reliability?

1		87.5%
2		44.9%
3		96.6%
4		35.4%
5		22.9%

(II) (5 values)

SOPROJETOS is planning the renovation of a building. The project manager identified the following activities and associated costs necessary to complete the renovation:

Activities	A	B	C	D	E	F	G	H	I
Precedencies	-	-	A	B	B,C	B,C	D,E	F	G,H
Average duration (days)	2	3	7	5	5	4	3	4	2
Standard-deviation (days)	1	2	3	1	1	2	1	3	2
Cost (€)	1500	2000	2500	1500	800	1300	1000	1000	1200

- a) [1.0] Draw the project network diagram;
- b) [1.0] Compute the project duration and identify the critical activities;
- c) [1.0] Estimate the impact of seven day postponement (delay) of activity D on the total duration of the project;
- d) [2.0] The renovation contract specifies that SOPROJETOS would receive a 10% bonus over the project value if it concluded the project at least two days before the expected completion date. However, a 15% penalty would be enacted should the project suffer a delay of one or more days. The project base value is 20,000€. What is the expected profit/loss SOPROJETOS expects to obtain?

Name _____ [7]

(III) (5.5 values)

RECHERCHE is specialised in the manufacture of the PROUST line of mechanical calendars, with the following past demand:

Year	1	2	3	4	5
Demand	7600	8300	7850	8200	8050

The start-up production cost is 60€ and the unit cost of one calendar is 15€.

The unitary annual holding cost is 25% of the production cost.

Currently, RECHERCHE has the ability to produce 247 units per week. Assume RECHERCHE works 50 weeks per year.

- a) [1.0] What is the optimal size of a production batch of PROUST calendars?**
- b) [0.5] Determine the cost associated with one production batch;**
- c) [1.0] Compute the number of units in inventory one week before the second production cycle is over.**

The MD is a component used in the manufacture of the PROUST calendars. Every year, RECHERCHE buys 40,000 MD components from an external supplier. Each component costs 1 € and, because of its fragility, each has a 4 € annual holding cost. The set-up of an order has a 12.5 € fixed cost. It is known that the lead-time for the delivery of the components by the supplier is normally distributed with a mean of 3 days and a standard deviation of one day. The level of service provided by RECHERCHE is of 99%.

- d) [1.0] Determine the time between orders for component MD;**
- e) [1.0] What is the reorder point RECHERCHE has established for the MD component?**
- f) [1.0] Compute the annual holding cost.**

(IV) (3.5 values)

The production manager of ZUMZUM, an aeronautical company, has the following planning information for the quarter starting on August 1, 2014:

	August	September	October	Unit cost (€)
Initial inventory	120			
Capacity				
Regular	370	420	300	25
Overtime	150	150	150	32
Subcontract	120	120	120	35
Demand	450	700	580	

ZUMZUM wishes to have 100 units in inventory by the end of October. The unit holding cost is 2€ per month.

(a) [2.0] Organise the data above on a double-entry matrix with the indication of the total quantities and respective costs (Note - a solution is not requested).

(b) [1.5] For the quarter starting on August 1, 2014 the manager devised the production plan below:

	Demand		
	August	September	October
Initial Inv.	120		
August			
Regular	300	10	60
Overtime			50
Subcont.	30		
September			
Regular		420	
Overtime		150	
Subcont.		120	
October			
Regular			200
Overtime			150
Subcont.			120

Organise on a table the costs, divided by nature and month, incurred with the proposed production plan.

Name _____ [13]

(V)(3.5 values)

An average of one client arrives every three minutes to the CARIMBADO print shop. Arrivals follow a *Poisson* process. CARIMBADO has two counters for the print jobs: an automatic self-service counter and a personalised service counter, with one employee. It is estimated that $\frac{3}{4}$ of the clients use the self-service counter, where they wait an average of 5 minutes before using the machine. The employee on the personalised service counter takes an average of 0.1 hours to serve a client with a standard deviation of 0.4 hours.

a)[1.0] What is the probability of a client having to wait to be served in the personalised counter?

b)[1.0] What is the average number of clients waiting on the queue for the self-service counter?

c)[1.5] What is the average time a personalised service client spends on the print shop store?

Name _____ [15]