

UNIVERSITY OF PORTSMOUTH

FACULTY OF TECHNOLOGY

Department of Electronic and Computer Engineering

M528 – Electronics Manufacturing

U09167

Date: 2 June 2008

Time: 09:00 – 10:30

INSTRUCTIONS

Write your student ID number clearly on page 2.

Write your answers to all 5 questions in this examination paper.

For each question, indicate your answer to **part A** by placing an “X” in the box next to the appropriate terms on the answer sheet. For each question, write your answer to **part B** by writing in the appropriate space in this examination paper.

Handwritten notes are permitted with this examination.

Calculators permitted are:

Casio FX 85WA

Casio FX 83WA

Casio FX 85MS

Examiner:

Professor Ron Pethig, Chi Nguyen

Student ID Number

****SOLUTIONS****

QUESTION 1A. Place an "X" in the box next to **3 terms** that are most directly related to the **evolution of methods for the production of goods.** [6 Marks]

<input type="checkbox"/>	liability	<input type="checkbox"/>	subscription
<input type="checkbox"/>	capital	2	craftsman
2	factory	<input type="checkbox"/>	taylorism
<input type="checkbox"/>	exchange	<input type="checkbox"/>	fordism
<input type="checkbox"/>	government	2	guild

QUESTION 1B. Use all of the terms you selected in question 1A to **compare 3 different methods for the production of chairs.** Provide **one advantage for each method** and **explain which method would produce the most durable chairs.** [14 Marks]

Similar to the following:

A **craftsman** would have the advantage of the most opportunity for applying creativity to producing chairs. [4]

A **guild** provided the advantage of combining the labour of apprentices with a master craftsman to produce a higher quantity of chairs. [4]

A **factory** has the advantage of a higher rate of consistency (predictability) in the quality and quantity of chairs produced in a given period of time. [4]

If quality is measured as durability, then a craftsman would be most likely to produce the highest quality and most durable chairs. [2]

QUESTION 2A. Place an "X" in the box next to **3 terms** that are most directly related to **options for buffering variability in a supply chain.** [6 Marks]

2	time		management
	components		distribution
	schedules	2	capacity
2	inventory		materials
	paths		batches

QUESTION 2B. Use all of the terms you selected in question 2A to describe **3 possible methods to buffer the variability in the supply chain for the Nintendo Wii** during a promotional sale period. Explain **which method would have the most business risk.**

[14 Marks]

Similar to the following:

Increase the estimated **time** for the assembly stage to a duration longer than necessary, for example, 150% of the usual time. If sales increase sharply, the extra time could be used to increase the number of assembled products. [4]

Increase the **inventory** quantity prior to the promotional sale period. [2]

Increase the **capacity** for manufacturing completed Nintendo Wii products through additional facilities, equipment, materials and suppliers. [4]

Increasing the inventory quantity has the most business risk because the cost of production is fixed, the cost of holding inventory is ongoing until products are sold and the sale price may be lower in the future. [4]

QUESTION 3A. Place an "X" in the box next to **3 terms** that are most directly related to **efficiency of variability pooling calculations.** [6 Marks]

<input type="checkbox"/>	retail price	<input type="checkbox"/>	logarithm
<input type="checkbox"/>	buy back price	2	square root
<input type="checkbox"/>	wholesale price	<input type="checkbox"/>	absolute value
<input type="checkbox"/>	standard error	2	normal distribution
2	standard deviation	<input type="checkbox"/>	binomial distribution

QUESTION 3B. Use all of the terms you selected in question 3A to **calculate the efficiency of variability pooling between using 10 warehouses as compared to 25 warehouses.** The manufacturer has **250 retail outlets.** Each retail outlet orders a **monthly average of 300 products** with a **standard deviation of 70 products.** The manufacturer has a **99.73% service level agreement** for order fulfilment. [14 Marks]

The equivalent **standard deviation** for 25 outlets serviced by 1 warehouse is:
 $(\text{square root of } 25) \times 70 = 350$ [2]

Using a **normal distribution**, a service level agreement for 99.73% requires 3 standard deviations of variable inventory for a warehouse servicing 25 outlets:
 $(300 \times 25) + (350 \times 3) = 8,550$ [2]

10 warehouses would require the manufacturer to maintain a total monthly inventory level of:
 $8,550 \times 10 = 85,500$ [2]

The equivalent standard deviation for 10 outlets serviced by 1 warehouse is:
 $(\text{square root of } 10) \times 70 = 221$ [2]

Using 3 standard deviations of variable inventory for a warehouse servicing 10 outlets:
 $(300 \times 10) + (221 \times 3) = 3,663$ [2]

The alternative of 25 warehouses would require a total monthly inventory level of:
 $3,663 \times 25 = 91,575$ [2]

The efficiency of variability pooling is:
 $(91,575 - 85,500) \div 91,575 = 6.6\% \text{ efficiency}$ [2]

QUESTION 4A. Place an "X" in the box next to **3 terms** that are most directly related to **possible benefits** of the design principle "**maintain independence of functional requirements**". **[6 Marks]**

	better for embedded use	2	modular design
	better for children to use		more technology
	reduce weight		mass market appeal
2	reduce maintenance		flexible customization
2	reduce critical failures		flexible packaging

QUESTION 4B. For **each of the 3 benefits** selected in question 4A, propose a **possible design for improving a mobile phone or a video game console** by applying the principle "maintain independence of functional requirements". **[14 Marks]**

Similar to the following:

A mobile phone could be improved by allowing the music or camera function to be used without a SIM card. This would **reduce critical failures** when a missing or malfunctioning SIM card could prevent use of music or camera functions. [4]

A mobile phone could be improved by having all user data automatically stored to an external memory device such as microSD. This would **reduce maintenance** costs by allowing storage devices to be upgraded without purchasing a new mobile phone (already available on some phones). [5]

A video game console could be improved by having an upgradeable processor similar to personal computers. This **modular design** would permit consumers to purchase processing power according to the amount and types of games they would like to play. [5]

QUESTION 5A. Place an "X" in the box next to **3 terms** that are most directly related to the typical **life cycle of an electronic product**. [6 Marks]

	engineering		advertisement
	warehousing	2	consumption
2	prototyping		valuation
	white box		shipping
	black box	2	sales

QUESTION 5B. For **each of the 3 product life cycle stages** selected in question 5A, propose **a method for reducing the environmental impact of televisions**. [14 Marks]

Similar to the following:

Prototyping could identify designs that make it easier to re-furbish a used television (replace outer case and essential parts). This would encourage re-use rather than recycling or disposing of the bulk of the television. [5]

The environmental impact during **consumption** (usage) of televisions could be reduced by functions such as auto power off during long periods of inactivity, e.g. 4 hours. [4]

During **sales**, a nominal trade-in value for old televisions would encourage customers to bring in old televisions for recycling. [5]