



Department of Electronic and Computer Engineering

B324 Electronics Manufacturing

Semester 2 Examination

1.5 hours

Instructions:

Write your student ID number clearly on page 2.

Write your answers to all 5 questions within the spaces provided in this examination paper. Handwritten notes are permitted with this examination.

Additional Information:

This is an open book exam

Provided:

NIL

Calculators:

Casio FX 85 Series or Casio FX 83 Series

Examiners:

Mr C Nguyen

External Examiner:

Dr A Rossiter

Student ID Number

SOLUTIONS

QUESTION 1

- a) Place an "X" in the box next to **3 terms** that are **significant differences between the craftsman and factory production methods.** [6 Marks]

	quantity of raw materials		inventory insurance
2	quantity of production tools		inventory management
	coordination of buyers		responsibility for theft
	coordination of sellers		responsibility for safety
2	coordination of workers	2	responsibility for quality

- b) Use all of the terms you selected in part (a) to **compare 2 similar products, but, one is produced using the craftsman method and the other is produced using the factory method.** [14 Marks]

Similar to:

Asus is a global computer manufacturer who primarily sell computers for general use. By comparison, gaming enthusiasts often have specific hardware requirements to create the best gaming experience possible. [2]

The factory production method used by Asus makes it difficult to assess and manage the responsibility for quality in the factory. By comparison, an individual gaming enthusiast who uses the craftsman method to build their own gaming computer clearly has the responsibility for quality. [4]

To produce a large quantity of computers, Asus invests enormous resources in the coordination of workers in the factory and across all related support functions such as marketing and finance. There is no coordination required when an individual gaming enthusiast builds their own gaming computer. They do not have access to any support functions, but, they have the flexibility of starting and stopping at anytime. [4]

The person who builds their own gaming computer must have all the tools necessary for every step in the production of the computer. This is not a scalable approach because each person who decides to build their own gaming computer must have all their own tools. By comparison, the quantity of production tools scale much better using the factory method, because each Asus employee involved in the computer production process only requires access to tools that are specific to their task. [4]

QUESTION 2

- a) Place an "X" in the box next to **3 terms** that are **forms of company stock** as it evolved through from the time of Royal Charters to the present day. [6 Marks]

	Stock capital
2	Joint-stock capital
	Mutual-stock capital
	Limited assets
	Limited subscriptions

	Corporate debt
2	Corporate shares
	Corporate capital
	Transferable writs
2	Transferable subscriptions

- b) Use all of the terms you selected in part (a) to provide a **brief description and comparison of the evolution of the company stock concept in chronological order** from the time of Royal Charters to the present day. [14 Marks]

Similar to:

After the use of Royal Charter to create companies limited by shares, Parliament passed an act which expanded access through joint-stock capital companies. The main difference was that a Royal Charter was no longer required to form private companies. However, once issued, joint-stock shares could not be transferred without the agreement of the other company members. [5]

Next came the development of transferable subscriptions, which provided the specific improvement that company shares could be transferred privately without the need to obtain agreement from other company members. This transferability reduced the risk of investing in limited companies because it was much easier to buy and sell company shares. Buying and selling company shares is greatly dependent on the information available about companies. At that time, there was no regulation about how company information was shared, which created new risks of financial fraud. [5]

The development of public exchanges facilitated the buying and selling of company shares and established regulations about how company information is disclosed to the public. These improvements made it more efficient for companies to find investors and reduced the risk of financial fraud through unfair access to company information or disclosure of false company information. The success of the public exchanges led to stocks being commonly known as corporate shares. [4]

QUESTION 3

- a) Place an "X" in the box next to **3 terms** that are **conceptual models for describing and comparing businesses**. [6 Marks]

2	sales
	retail
	service
	wholesale
	warehouse

	independent
	cooperative
2	coordination
	distribution
2	capabilities

- b) **Select 2 companies** who compete against each other in the electronics industry. **Briefly describe how constraints are expressed in each model** and **compare the companies by using each of the conceptual models** you selected in part (a). [14 Marks]

Similar to:

Acer and Apples are 2 competitive computer businesses.

The capabilities model expresses constraints using concentric circles. Acer owns a wide range of production resources which provide them with a wide range of capabilities, which suggests an emphasis on the innermost circle in the model. Apple primarily own design and marketing resources, which provide them with a smaller number of capabilities. Apple's widely known emphasis on secretive agreements with their suppliers and manufacturers suggest an emphasis on the outermost circle representing their relationships with partners in their supply chain. [5]

The coordination model expresses constraints through the integration of ownership and coordination over production resources. The higher the level of integration indicates a greater amount of constraints. Acer has complete or majority ownership in many different types of businesses that cooperate to produce Acer computers. This model has a high level of ownership integration and low level of coordination integration. Apple owns its core design and marketing resources while depending on partners for many other production capabilities. This model has a low level of ownership integration and a high level of coordination integration. [5]

Constraints are expressed in the sales model from left to right. The financial value of a component in the model is dependent on the value of the component adjacent on its left side. Acer actually builds its own computers, so its ability to manage overhead costs and the prime cost make the most impact on its profit level. Apple outsources its manufacturing, so its ability to manage sales and marketing costs and the total costs of manufacturing make the most impact on its profit level. [4]

QUESTION 4

- a) Place an "X" in the box next to **3 terms** that refer to **aspects of electronics manufacturing which are most often optimised by using linear programming.** [6 Marks]

	taxes
	skills
	assets
2	profits
	liabilities

	production markets
2	production planning
2	production resources
	interchangeable parts
	interchangeable tools

- b) Use all of the terms you selected in part (a) to **identify and briefly explain the purpose of each part of the linear programming problem below. Support your explanations using values in the problem below.** [14 Marks]

$$\begin{aligned} &\text{maximize } z = 3x_1 + x_2 \\ \text{such that} & \\ &12x_1 + 14x_2 \leq 85 \\ &3x_1 + 2x_2 \leq 18 \\ &x_2 \leq 4 \\ \text{and} & \\ &x_1, x_2 \geq 0 \end{aligned}$$

Similar to:

In the manufacturing context, programming refers to the activities of production planning. One of the most common goals of production planning is to maximize profits, which is represented as the objective function z . In the example, the objective function indicates that the sale of product x_1 contributes 3 times more to profit than the sale of product x_2 . [6]

If there were no constraints, then every company would increase their profits infinitely. The constraints are expressed as the linear functions in the "such that" clause. The linear functions often represent the use and availability of production resources, which are finite and limited. Linear programming is used to optimise the allocation of production resources. In the example, the availability of one production resource is limited to 85, of which, 12 is required to manufacture each product x_1 and 14 is required to manufacture each product x_2 . Similarly, another production resources is limited to 18, of which, 3 is required to manufacture each product x_1 and 2 is required to manufacture each product x_2 . The third production resource is limited to 4, but, none is required for product x_1 and only one is required to manufacture each product x_2 . [6]

The last part of the linear programming problem is the nonnegativity constraint, which represents the real world requirement that production resources may not take on negative quantities. [2]

QUESTION 5

- a) Place an "X" in the box next to **3 terms** that are directly involved in **analysing pooling variability to determine the optimal efficiency of inventory buffering configurations**. [6 Marks]

	standard error
2	standard deviation
	standard variation
	pooling agreement
2	service level agreement

	excess inventory
	contingency inventory
	absolute efficiency
	standard efficiency
2	comparative efficiency

- b) For each of the terms you selected in part (a), indicate its value in the analysis of the pooling variability scenario below. [14 Marks]

A manufacturer has 24 retailer customers. Each customer orders a monthly average of 600 products, with a monthly variation of 84 products. The manufacturer has committed to fulfil orders at a 99.73% rate. Analyse the pooling variability of using one warehouse per customer versus one warehouse per 6 customers.

Similar to:

84 is the standard deviation. [1]

99.73% is the service level agreement. [1]

In the case of one warehouse per customer, each warehouse requires inventory of:
 $600 + (84 * 3) = 852$ [2]

For 24 warehouses, the manufacturer requires a total inventory of:
 $852 * 24 = 20,448$ [1]

In the case of one warehouse per 6 customers, the equivalent standard deviation for the group of 6 customers is:

$$\sqrt{6} * 84 \approx 206 \quad [2]$$

To serve 6 customers, each warehouse requires inventory of:
 $(600 * 6) + ((\sqrt{6} * 84) * 3) \approx 4,217$ [2]

For 4 warehouses, the manufacturer requires a total inventory of:
 $4 * ((600 * 6) + ((\sqrt{6} * 84) * 3)) \approx 16,869$ [1]

The comparative efficiency is: [2]

$$3,579 \div 20,448 \approx 18\% \quad [2]$$