



Department of Electronic and Computer Engineering

## **B324 Electronics Manufacturing**

### **Semester 2 Examination**

**1.5 hours**

<b>Instructions:</b>	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.
<b>Additional Information:</b>	This is an open book exam
<b>Provided:</b>	None
<b>Calculators:</b>	Casio FX 85 Series or Casio FX 83 Series
<b>Examiners:</b>	Mr C Nguyen
<b>External Examiner:</b>	Professor R Pethig

**Student ID Number**

**\*\*\* SOLUTIONS \*\*\***

**QUESTION 1**

(a) Place an "X" in the box next to **3 issues** that have been **most directly and significantly affected** by the **division of labour** principle. [6 Marks]

<input type="checkbox"/>	intra-company competition	<input type="checkbox"/>	agricultural revolution
<input type="checkbox"/>	economic competition	<b>2</b>	gender stereotypes
<b>2</b>	career progression	<input type="checkbox"/>	age stereotypes
<b>2</b>	international trade	<input type="checkbox"/>	product recycling
<input type="checkbox"/>	regional trade	<input type="checkbox"/>	waste recycling

(b) Provide an **explanation of the effects due to the division of labour principle** and a **supporting example** for **each of the terms** selected in part (a). [14 Marks]

*Similar to the following:*

Division of labour encourages specialization of skills. This approach worked well when employees were more likely to work at one, or a few, companies for most of their career. However, as workers are changing jobs more frequently, specialization of skills is causing **career progression** problems because it is reducing the potential for people to work at new jobs or in different industries. For example, workers who work for a long time at call centres often lack skills to change to other technical jobs. [5]

**International trade** is often characterized as developed countries shifting low paying and less skilled work to emerging market countries. This form of division of labour is most visible in stereotypes of USA and UK for white collar scientific output and China for blue collar factory products. Although this level of specialization could help emerging market countries to rapidly grow, it could also reduce their potential to compete with the developed countries in the future as they exhaust their own natural resources and failed to develop new skills for higher valued products. [5]

**Gender stereotypes** have existed for a long time and for a number of changing reasons that were indirectly supported by the division of labour approach to work specialization, e.g. physical strength, working conditions and access to education. The most visible form of gender stereotype today is the glass ceiling problem for female employees in senior positions. [4]

**QUESTION 2**

(a) Place an "X" in the box next to **3 areas** that have **the most differences** between the **craftsman production method** as compared to the **factory production method**. [6 Marks]

2	responsibility for quality		access to transportation
	responsibility for safety		access to markets
	international skill level		production resources
2	individual skill level		production location
	national skill level	2	production tools

(b) Provide an **explanation for the difference** and a **supporting example** for **each of the terms** selected in part (a). [14 Marks]

*Similar to the following:*

The **responsibility for quality** becomes more difficult to manage as more people, tools and processes are involved in a factory production method. The craftsman production method has significantly less people, tools and processes involved, which makes it easier to identify specific people, tools or processes to improve the quality of a product. For example, it is easier to identify errors in a software program written by a few people than to identify errors written in a software package developed by numerous people spread between several cities. [5]

The craftsman production method generally requires a wider amount and range of skills from the people involved in product manufacturing. As a result, people find it more compelling to continually develop and expand their **individual skill level**. By comparison, the factory production method generally promotes specialization of skills in a specific area. As a result, people can be successful in a factory production environment by incrementally specializing in specific skills rather than expanding the range of their overall skills. For example, someone who builds custom cars are more likely to have a wider range of skills than someone who works on the assembly line at an automobile factory. [4]

The craftsman production method encourages duplication at great expense because each craftsman is responsible for the purchase, operation and maintenance of their own **production tools**. By contrast, the factory production method generally only requires each worker to have access to specific tools required for their specialized tasks. There is significant savings by not providing access to a complete set of tools for each worker. For example, there is much less tools required to assemble computers from parts than to produce the original components such as a microprocessor. [5]

**QUESTION 3**

(a) Place an "X" in the box next to **3 issues** that are **most significantly different** between a person who operates a business as **self-employment or sole proprietor** as compared to a person who operates a business as a **company limited by shares**. [6 Marks]

	product development		intellectual property
	production tools	2	legal entity
	startup costs	2	ownership
	marketing		location
2	liability		sales

(b) Provide an **explanation of the difference** and a **supporting example** for each of the terms selected in part (a). [14 Marks]

*Similar to the following:*

In a sole proprietor or self-employment, the person is entirely responsible for all legal and financial obligations arising from business activities. By comparison, the limited company is separately liable for legal and financial obligations arising from business activities and the liabilities of the shareholders are only limited to a maximum amount equal to their investment in the company. For example, if there is a product failure that causes injury, a sole proprietor would be responsible for the related liabilities, while a shareholder in a limited company would have no consequent **liability**. [5]

There is only one **legal entity** in a sole proprietor or self-employment. By comparison, a limited company is a separate legal entity from its shareholders. This is most visible by the ease with which shareholders may change with almost no direct effects on a limited company. By comparison, there are more immediate effects when a sole proprietor or self-employed person decides to stop trading and sell their business. For example, ownership of limited companies listed on public exchanges change almost daily with minimal impact on the actual business. [4]

The **ownership** of a sole proprietor or self-employment is fully linked to the individual and there is no convenient method to share or transfer ownership of the business. By comparison, ownership of a limited company is separate from any individual and measured only by issuance of shares. There are convenient legal mechanisms to share or transfer ownership of limited companies. As such, limited companies are better for aggregating larger amounts of financial capital. For example, it would be difficult to sufficiently share ownership and raise capital to build semiconductor fabrication facilities without the flexibility of limited companies. [5]

**QUESTION 4**

(a) Place an "X" in the box next to **3 terms** that are **most directly related** to the use of **linear programming in supply chain planning and analysis**. [6 Marks]

	minimum function	<b>2</b>	objective function
	maximum function		input constraints
	matrix parameters		optimal constraints
	product parameters	<b>2</b>	functional constraints
	business parameters	<b>2</b>	nonnegativity constraints

(b) Formulate the following problem so that it can be solved using linear programming. Identify the specific part for each of the terms selected in part (a). [14 Marks]

A small factory generates 11 containers of waste solvents, 14 containers of waste acids and 18 containers of waste oils on a daily basis. Express Waste charges £400 for each truck that they send to collect waste containers. Each truck may carry 1 container of waste solvents, 2 containers of waste acids and 3 containers of waste oils. Global Waste charges £600 for each truck. But, each truck may carry 2 containers of waste solvents, 2 containers and waste acids and 2 containers of waste oils. Identify the lowest cost for the factory to properly dispose of its waste each day.

The **objective function** is: [1]

minimize  $z = 400x_1 + 600x_2$  [1]

where

$z$  = daily cost for waste collection trucks [1]

$x_1$  = number of trucks from Express Waste [1]

$x_2$  = number of trucks from Global Waste [1]

The **functional constraints** are: [1]

$1x_1 + 2x_2 \geq 11$  [2]

$2x_1 + 2x_2 \geq 14$  [2]

$3x_1 + 2x_2 \geq 18$  [2]

The **nonnegativity constraints** are: [1]

$x_1, x_2 \geq 0$  [1]

**QUESTION 5**

(a) Place an "X" in the box next to **3 terms** that are **most directly related** to the classic inventory model, **Economic Order Quantity (EOQ)**. [6 Marks]

	unit holding time		optimum revenue per year
2	unit holding cost	2	optimum orders per year
	unit holding revenue		optimum profits per year
	total annual inventory		planned annual revenue
2	total annual cost of inventory		planned annual orders

(b) Calculate the **average order frequency** using the EOQ model and the values provided below. [14 Marks]  
**Indicate the values for each term selected in part (a).**

- |  |                        |
|--|------------------------|
| On average, 40 products sold per day           | Each product costs £50 |
| On average, business is open 200 days per year | Each order costs £25   |
| Annual cost of storage is 25% of product costs |                        |

Let the annual demand be D:

$$D = 40 \times 200 = 8000 \text{ products} \quad [1]$$

Let the **unit holding cost** be H:

$$H = £50 \times 0.25 = £12.50 \quad [3]$$

Apply the EOQ equation:

$$\sqrt{\frac{2 \times 25 \times 8000}{12.50}} = 178.89 \quad [4]$$

The average order frequency is a synonym for the **optimum orders per year**:

$$8000 \div 178.89 = 44.7 \quad [3]$$

The **total annual cost of inventory** is one extra calculation:

$$178.89 \times £12.50 = £2236.07 \quad [3]$$