BOARD OF STUDIES
NEW SOUTH WALES

2012

HIGHER SCHOOL CERTIFICATE EXAMINATION

Information Processes and Technology

General Instructions

- Reading time – 5 minutes
- Working time – 3 hours
- Write using black or blue pen
  Black pen is preferred
- Draw diagrams using pencil

Total marks – 100

Section I Pages 2–8

20 marks

- Attempt Questions 1–20
- Allow about 40 minutes for this section

Section II Pages 9–12

40 marks

- Attempt Questions 21–24
- Allow about 1 hour and 10 minutes for this section

Section III Pages 14–20

40 marks

- Attempt TWO questions from Questions 25–28
- Allow about 1 hour and 10 minutes for this section

Section I

20 marks
Attempt Questions 1–20
Allow about 40 minutes for this section

Use the multiple-choice answer sheet for Questions 1–20.

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1 Which protocol would be most appropriate to send a client ID and password to an online banking system?

(A) Secure Socket Layer (SSL)

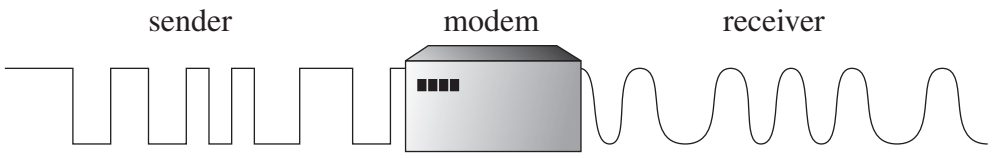
(B) File Transfer Protocol (FTP)

(C) Hypertext Transfer Protocol (http)

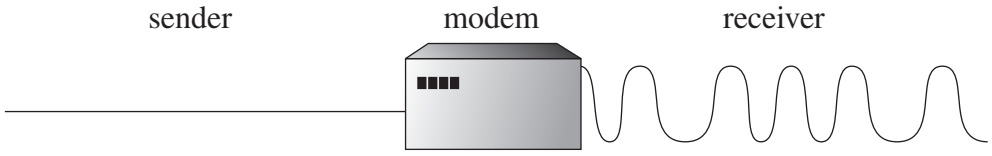
(D) Portable Document Format (PDF)

2 Which of the following diagrams best represents digital to analogue conversion?

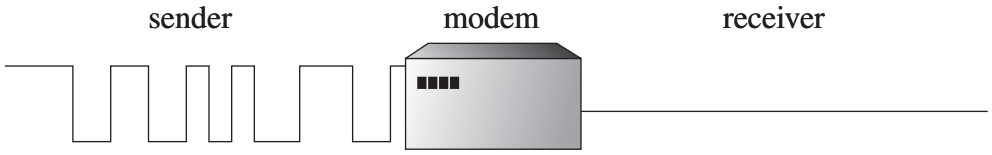
(A)



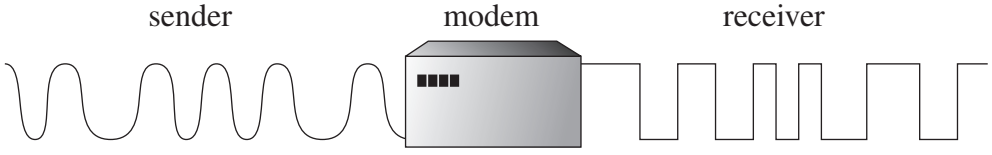
(B)



(C)



(D)



3 In which of the following documents will potential costs associated with a new system be included?

(A) Gantt chart

(B) User manual

(C) Process diary

(D) Feasibility report

4 The diagram shows a portion of a network.

What term is used to describe Computer 1 in the diagram?

(A) Fat client

(B) Web server

(C) Thin client

(D) Mail server

5 Which of the following describes the organisation of hypermedia?

(A) Nodes and links

(B) Files and records

(C) Online and offline storage

(D) Direct and sequential access to data

6 Which of the following best describes *handshaking* between two communication devices?

(A) Modulation of a signal

(B) Process to encrypt a message

(C) Establishment of an agreed protocol

(D) Detection and correction of transmission errors

7 Which of the following transmission media only allows transmission if the sender and the receiver are in line of sight?

(A) Optic fibre

(B) Microwave

(C) Coaxial cable

(D) Twisted pair

8 The cable shown in the diagram carries digitised data.

What type of waves are carried by this cable?

(A) Radio waves

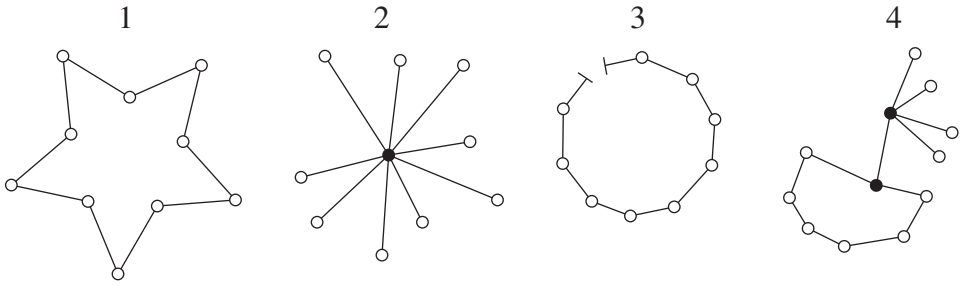
(B) Microwaves

(C) Sound waves

(D) Light waves

9 Four network topologies are shown.

KEY
○ Node
● Server
— Transmission medium
—⊣ Terminator



Which row in the table correctly identifies the types of network topologies shown?

	1	2	3	4
(A)	star	bus	ring	hybrid
(B)	ring	star	bus	hybrid
(C)	ring	star	hybrid	bus
(D)	star	hybrid	bus	ring

10 The following 8-bit ASCII character and a parity bit were transmitted without error.

ASCII character	Parity bit
00110010	1

Which of the following would result in an error message if sent using the same parity?

(A)	01010111	1
(B)	01100101	1
(C)	10111000	0
(D)	00010010	0

11 A new database system for the management of records has been implemented in a doctors' surgery. Paper records will continue to be used until all staff are trained and confident in using the new system.

Which conversion method is being used?

(A) Direct

(B) Parallel

(C) Phased

(D) Pilot

12 The table shows a partial data dictionary from a database.

Field name	*Size*	*Data type*
IDnum	10	number
Surname	20	text
Firstname	20	text
Phone	10	text

What is the approximate amount of memory needed to store 10 000 records in this database?

(A) 60 Kb

(B) 600 Kb

(C) 6000 Kb

(D) 60 000 Kb

13 Users have recognised that there are problems with an existing information system.

Which of the following would help in finding the cause of the problem?

(A) Identifying participants

(B) Producing a new Gantt chart

(C) Analysing the system

(D) Retraining participants to use the system

14 Within a school database, which of the following describes the relationship between data in a student table and data in a subject table?

(A) One to one

(B) One to many

(C) Many to one

(D) Many to many

15 In free text search, the * symbol can be used to replace 0 to 7 characters in a word, not including white space.

Which of the following searches would locate all three words 'hypermedia', 'multimedia' and 'hypertext'?

(A) media* OR hyper*

(B) multi* OR hyper*

(C) *multi AND *text

(D) *media AND *hyper

16 This image shows detail of an emerging technology used in luggage tags to track items being transported from the check-in area at an airport to different aircraft.

What technology is this?

(A) Optical Character Recognition

(B) Radio Frequency Identification

(C) Magnetic Ink Character Recognition

(D) Transmission Control Protocol/Internet Protocol

17 Which issue needs to be considered when many organisations store data with one common identifier, such as a tax file number?

(A) Data matching

(B) Ownership of data

(C) Freedom of information

(D) Acknowledgement of data sources

18 A multinational company has its database located in Sydney. The database is accessed from offices in various countries. What type of database is being used?

(A) Centralised

(B) Distributed

(C) Redundant

(D) Schematic

19 How does a print server on a client-server network interact with the user when it is reporting the status of a print job to the client?

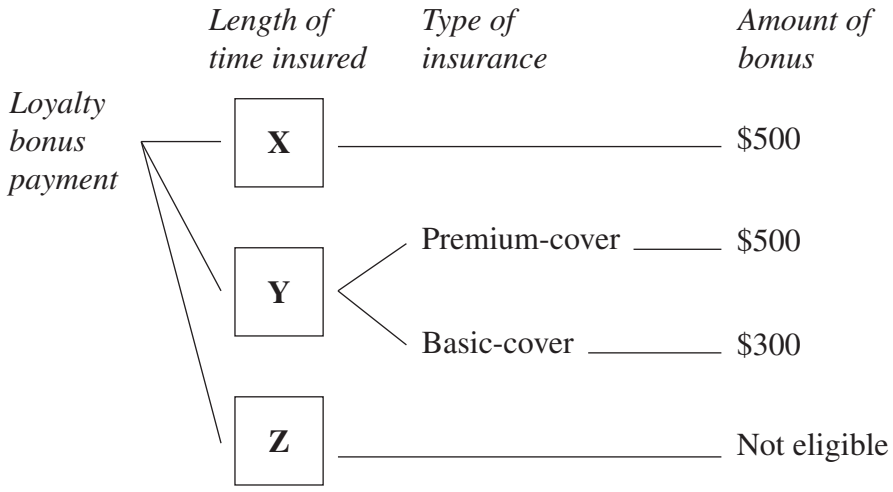
(A) The transmitter determines the address of the user.

(B) The print server is the receiver of the transmission medium.

(C) It is the source of the message being sent to the destination.

(D) It is the destination of the message being sent by the source.

20 An insurance company pays a loyalty bonus to customers who have been insured for at least six months. In their first year with the company, Premium-cover customers receive $500 and Basic-cover customers get $300. After one year all customers receive a $500 bonus.



Which of the following shows the correct set of conditions for X, Y and Z?

	X	Y	Z
(A)	> 1 year	≥ 6 months AND ≤ 1 year	< 6 months
(B)	> 1 year	≥ 6 months OR ≤ 1 year	< 6 months
(C)	< 1 year	≥ 6 months AND ≥ 1 year	> 6 months
(D)	< 1 year	≥ 6 months OR ≤ 1 year	> 6 months

Section II

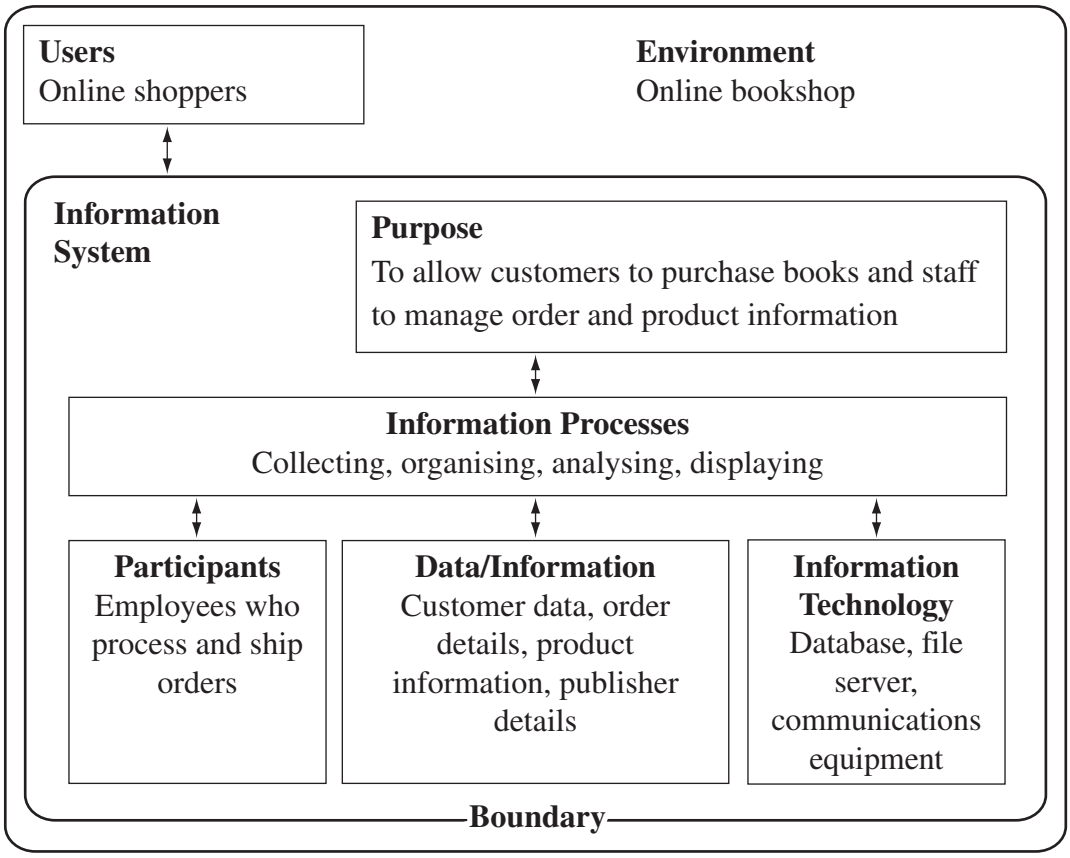
40 marks
Attempt Questions 21–24
Allow about 1 hour and 10 minutes for this section

Answer each question in the appropriate writing booklet. Extra writing booklets are available.

If you include diagrams in your answer, ensure that they are clearly labelled.

Question 21 (11 marks) Use the Question 21 writing booklet.

An *information system in context* diagram is shown for an online bookshop.



(a) Name TWO fields for a CUSTOMER table in the database used by this information system and identify their data types. **2**

(b) Identify the information technologies that a customer would need to access the online bookshop from home. **3**

(c) Describe a feature that developers would include to help users successfully place an order. **2**

(d) Different employees are able to access different data views from the database. **4**

Sketch a database view that would be displayed on the screen of employees who pack and dispatch book orders, and justify the information that you have included.

Question 22 (10 marks) Use the Question 22 writing booklet.

Emergency response personnel are devising a system to equip all motor vehicles with a crash sensor in order to manage the appropriate emergency response. The system will be able to:

- detect that a motor vehicle accident has taken place
- send a signal to an emergency '000' (triple zero) base station, indicating the exact location of the vehicle on a map, and
- predict the injury-producing capabilities of the crash.

This system can be installed anywhere in the vehicle. The system contains GPS capabilities, crash sensors and microprocessors which will be connected to the 3G network. Once a crash occurs it will take up to 60 seconds to transmit a signal to the emergency base station. An antenna will be placed on top of the car to help carry the signal.

Monitoring of the system will be by emergency response workers who will gather further information from phone calls that follow the initial crash detection. Multiple calls from cars at the crash location will further indicate the severity of a crash.

(a) Sketch a diagram representing the path of data transmission from the car to the base station. Label your diagram to indicate the transmission media. **2**

(b) Recommend a development approach that would be appropriate for the above scenario. Justify your choice. **3**

(c) How will the new system change the nature of work for emergency response telephone operators? **2**

(d) Describe how the data collected by the crash sensor would be formed into data packets. You may use a diagram to support your answer. **3**

Question 23 (10 marks) Use the Question 23 writing booklet.

This is a portion of a flat-file database containing data from a library.

Item	*Item Number*	*Borrower*	*Type*	*Date borrowed*	*Date returned*	*Number of times borrowed*
IPT Today	A 0103	Jack Jones	Book	31-01-12	29-02-12	6
Lecture #1	B 0402	John Jones	CD	07-02-12	07-03-12	9
Repair a PC	C 0303	Jack Smith	DVD	05-04-12	06-05-12	15
Tech Zone	A 0401	Mary Smith	Periodical	06-06-12	08-06-12	32
Comm Sys Frame	D 0202	Sally Green	Poster	07-07-12	09-07-12	1

(a) Describe TWO problems that could arise from using this flat-file structure as a database and propose a solution for each. **3**

(b) Normalise this flat-file structure into three tables. Indicate necessary relationships and label primary and foreign keys. **4**

(c) A new library has all of its books, periodicals and audio-visual materials stored in a large automated storage area located under the building. **3**

Recommend and justify the most appropriate way to store each item to allow for ease of retrieval.

Question 24 (9 marks) Use the Question 24 writing booklet.

Open source software (OSS) is an emerging technology that has evolved with the use of the internet. OSS is developed in a new copyright and licensing environment where one goal is to provide software at no cost to the public. Users of OSS have free access to the software, but they also take responsibility for its ongoing maintenance and help desk support.

Recent examples of open source projects include the Firefox browser and the Android operating system. An open source project is undertaken in a collaborative environment by a skilled team, often with members in diverse countries who communicate remotely using online chat, video conferencing and editing of shared documents. Teams often use the internet to recruit other members and to make their projects available. Also, other development teams are able to revise and improve the product and to provide greater variety of features to the community.

(a) Identify the participants of an open source project and describe how they can contribute to the development of the project. **2**

(b) Design a screen display that would allow team members from different locations to collaborate. **2**

(c) Discuss positive and negative issues that you should consider if you were responsible for the installation, maintenance and help desk support of a large open source software product in an organisation. **5**

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Section III

40 marks
Attempt TWO questions from Questions 25–28
Allow about 1 hour and 10 minutes for this section

Answer each question in a SEPARATE writing booklet. Extra writing booklets are available.

If you include diagrams in your answer, ensure that they are clearly labelled.

Question 25 — Transaction Processing Systems (20 marks)
Use a SEPARATE writing booklet.

(a) (i) Define an online transaction processing system (OLTP). **1**

(ii) Describe the importance of data backup to the online submission of student assignments. **2**

(iii) Explain reasons for using batch processing systems. **3**

Question 25 continues on page 15

(b) MegaShop, a multinational retail company, has just taken over MiniShop, an Australian company. MegaShop needs to make changes to its systems so that the existing processes and data of MiniShop are preserved but integrated with the MegaShop systems and data.

The analysts have arrived at two possible alternatives:

Option 1. Maintain the two existing systems but allow each company access to the data of the other company.

Option 2. Integrate the systems from the two companies using an enterprise resource planning (ERP) system to create MegaShop ERP.

ERP systems integrate information across an entire organisation providing modules for:

- finance and accounting
- retail and business processes
- retail sales and servicing
- human resources
- customer support
- supply chain management.

(i) Describe alternative procedures that might need to be followed if the retail sales and servicing module of the ERP system becomes unavailable. **2**

(ii) Why would the opportunity for data mining provided by the MegaShop ERP be an advantage for the multinational company? **3**

(iii) Compare Option 2, where the ERP integrates the two systems with Option 1, where the two existing systems are maintained. **4**

(iv) Discuss an alternative application of an ERP that uses a centralised database to store transactions. In your answer, consider the information processes of organising and storing to integrate data. **5**

End of Question 25

Question 26 — Decision Support Systems (20 marks)
Use a SEPARATE writing booklet.

(a) (i) How do 'what-if' models assist decision making? **1**

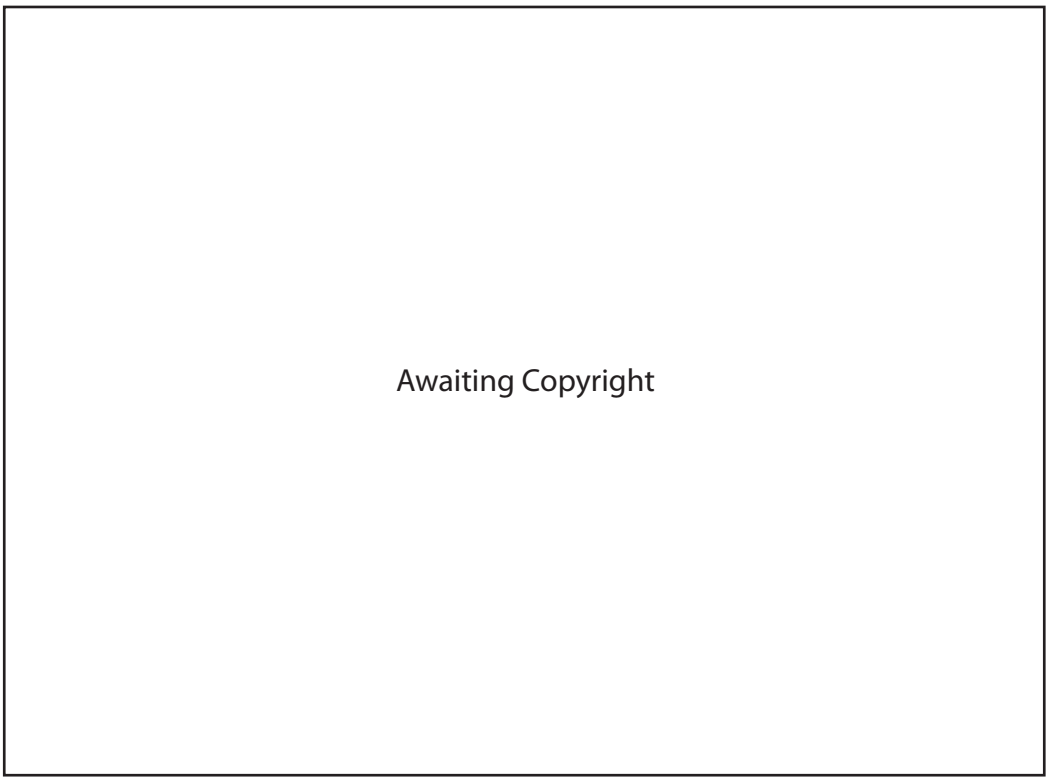
(ii) Describe how macros are used in spreadsheets. **2**

(iii) Discuss implications arising from automated decision making. **3**

(b) The CSIRO has developed a software package, SiroFire, to help fire fighters respond to fires more effectively.

SiroFire uses information such as temperature and relative humidity, wind speed and direction, fuel load and conditions, and slope and terrain to predict the spread of a bushfire. SiroFire plots the fire perimeter on a map. Geographic maps and digital terrain models are used to graphically present the spread of the fire over the map display. Knowing in advance where to put the ground crews is a powerful weapon in the fight to save lives and property, and to protect fire fighters.

The following screenshot shows the predicted path of a fire using SiroFire.



Question 26 continues on page 17

Question 26 (continued)

(i) Identify the computer hardware necessary to support SiroFire. **2**

(ii) Name a category of decision support systems that SiroFire represents and justify your answer by describing distinguishing characteristics. **3**

(iii) Discuss the issues related to SiroFire's data collection from multiple sources in terms of the implications for data quality. **4**

(iv) Suggest an alternative application that could use data from multiple sources displayed geographically. In your answer, consider a processing method that could be used by the information system to recommend solutions. **5**

End of Question 26

Question 27 — Automated Manufacturing Systems (20 marks)
Use a SEPARATE writing booklet.

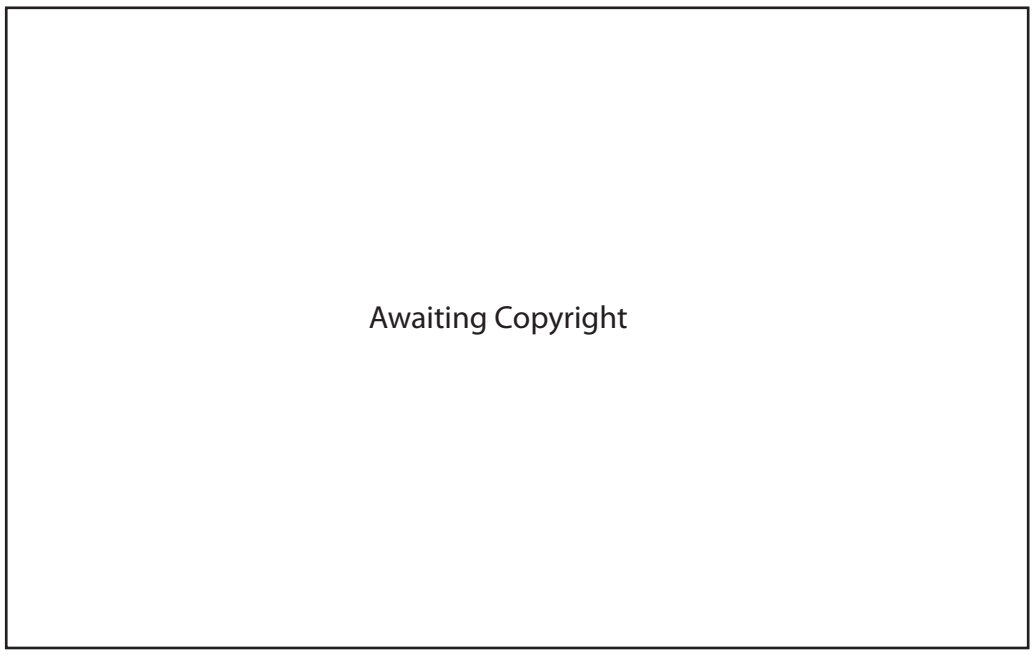
(a) (i) Give an example of an automated manufacturing situation where a robotic arm would be used. **1**

(ii) Describe a suitable sensor to detect a car at a set of adaptive traffic lights. **2**

(iii) Explain how CNC systems are used in CAD/CAM systems. **3**

Question 27 continues on page 19

(b) IPTSecurity Robots are being deployed in some industrial and warehouse facilities. These robots are powered by batteries and they can patrol the premises continuously for up to 12 hours. When the battery power source of a robot reaches a certain predetermined low level, the robot moves to seek a power outlet to recharge, connecting with a cable using a magnetic plug.



The robots have sensors to perform three functions: detect movement to identify intruders; record temperature of the surrounding environment; and detect toxic gases and radiation. The robots have a camera to provide a continuous video display to the Control Centre. Each robot constantly relays to the Control Centre the measurements from the sensors as well as its own status in terms of its location coordinates and power level.

(i) Describe the physical operation of a sensor installed on the mobile security robot. **2**

(ii) In what way is the IPTSecurity system human-centred? **3**

(iii) Assume that a warehouse has 20 such mobile robots patrolling its premises, and each robot is relaying its measurements to the Control Centre as described above. **4**

Explain the features and processes of the information system needed in the Control Centre for the information processes of processing and displaying data from the robots.

(iv) Discuss a potential alternative application of remotely monitored roaming robots with sensors in hazardous environments. In your answer, consider the process of collecting and how the technology can be further developed. **5**

End of Question 27

Question 28 — Multimedia Systems (20 marks)
Use a SEPARATE writing booklet.

(a) (i) Define *simulation*. **1**

(ii) How has tweening helped save time when creating animations? **2**

(iii) Identify similarities and differences between printed and multimedia versions of the same content. **3**

(b) HiTech University is an online university. Students access e-books from the library, videos, conferences and discussion boards to assist them with their work. All students can obtain work, attend virtual classes and submit work online from home.

Teachers and students interact in a virtual classroom for each subject.

Students communicate with the teacher using virtual classroom technology. The teacher then responds with explanations or uses the virtual board within the virtual classroom.

(i) Describe an accessibility issue relating to the use of this system. **2**

(ii) Photography students have been experiencing problems sending in their photos due to large file sizes. Discuss TWO methods that could be used to reduce file size. **3**

(iii) Analyse the different media suitable for use in displaying this system. **4**

(iv) Consider the range of emerging technologies relevant to multimedia systems to predict new technologies that could be used to enhance online learning. In your answer, consider flexibility for participants. **5**

End of paper