

Computer science
Higher level
Paper 1

Specimen paper

Candidate session number

2 hours

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Instructions for candidates

- Write your session number in the boxes above.
- Do not open this examination paper until instructed to do so.
- A clean copy of the **computer science case study** is required for this examination paper.
- Read the case study carefully.
- Section A: answer all the questions.
- Section B: answer the question.
- Answers must be written within the answer boxes provided.
- The maximum mark for this examination paper is **[80 marks]**.



Section A

Answer **all** questions from this section. Answers must be written within the answer boxes provided.

1. A team of programmers use platform as a service (PaaS) via their laptops to develop a software application.

(a) Outline the function of an accumulator.

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(b) State the binary equivalent of the hexadecimal number AC.

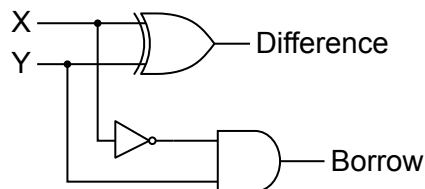
[1]

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(c) Construct a truth table for the following circuit:

[2]



X	Y	Difference	Borrow

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(Question 1 continued)

- (d) Outline the role of accounting in an operating system. [2]

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- (e) Outline why platform as a service (PaaS) is a suitable environment in which to build applications. [2]

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- (f) Explain why the execution speed of compiled code is faster than that of interpreted code. [4]

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2. A hospital has a local area network (LAN) connected to the internet to provide access to cloud services.

(a) State **one** network device used to connect the local area network (LAN) to the internet. [1]

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The TCP/IP model was developed to facilitate reliable and robust communication over a network.

(b) Describe the function of the network interface layer of the TCP/IP model. [2]

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A router uses a fiber-optic cable to connect directly to an internet service provider's equipment.

(c) List **three** advantages of using a fiber-optic cable instead of a twisted-pair cable. [3]

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(Question 2 continued)

(d) Explain how a switch routes data packets across a network.

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The hospital deploys a hardware firewall incorporating network address translation (NAT).

(e) Explain **one** function of network address translation (NAT) in a firewall.

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3. A hospital stores patients' data in a relational database.

The database view, VISITS, is an extract showing the dates patients visited the hospital for an appointment.

The VisitDate field represents the date of each patient's appointment.

PatID	PatientName	PatientDOB	DocID	Doctor	VisitDate	Treatment
1	Samuel Moody	2007/06/11	1	Jill Smith	2025/01/11	Bone scan
1	Samuel Moody	2007/06/11	2	Norayr Lomidze	2025/01/12	Physical therapy
2	Lin Kobayashi	1984/02/24	1	Jill Smith	2025/01/12	Physical therapy
3	Yejoo Kim	1999/08/18	3	Phoebe Drakos	2025/01/13	Radiation therapy
3	Yejoo Kim	1999/08/18	3	Phoebe Drakos	2025/01/14	Therapy part 1

- (a) Construct an SQL SELECT query to list the names of patients whose treatment includes the word "therapy".

A patient's name should only appear once.

[3]

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(Question 3 continued)

The database view, VISITS, can be represented by the following notation:

VISITS (PatID, PatientName, PatientDOB, DocID, Doctor,
VisitDate, Treatment)

- (b) Construct the database in third normal form (3NF) for the three entities in the VISITS view extract.

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The hospital has transitioned its database system to a distributed model. Atomicity can be applied across multiple nodes when transactions are executed.

- (c) Describe how atomicity manages transactions across multiple nodes.

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Answers written on this page
will not be marked.



(Question 3 continued)

The hospital's research laboratory tracks virus outbreaks. A spatial database stores the addresses of patients who have contracted a virus.

- (d) Outline why a spatial database is used to store the addresses of patients who have contracted a virus.

[3]

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4. A hospital uses a deep learning convolutional neural network (CNN) to analyse chest X-rays and predict the likelihood of a patient developing pneumonia.

(a) State **one** of the layers in a convolutional neural network (CNN).

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(b) Identify **one** reason data cleaning is carried out before training a convolutional neural network (CNN).

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(c) Outline **one** reason a graphics processing unit (GPU) is recommended when training a deep learning convolutional neural network (CNN) model using a large dataset.

[2]

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(d) Describe how the deep learning convolutional neural network (CNN) model could be evaluated using an F1 score.

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(Question 4 continued)

The hospital purchased a self-learning robotic cleaner that uses reinforcement learning (RL).

- (e) Justify why a robotic cleaner would use reinforcement learning (RL) instead of supervised learning (SL).

[3]

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A deep learning algorithm was implemented to automatically monitor the hospital's social media sites. The model uses natural language processing to classify comments into categories like "compliments" and "complaints".

Members of the public are asked to remove any comments that are not supported by evidence. However, the hospital's CEO is concerned about the ethical issues of doing this, as it may be considered online harassment.

- (f) Discuss whether the hospital should ask members of the public to retract their comments. [5]

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Section B

Answer the following question, which refers to the case study. Answers must be written within the answer boxes provided.

5. Ransomware and rootkit are types of malware.

(a) (i) Identify **two other** types of malware.

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A phishing attack caused ransomware to be installed on TaylorMade Healthcare's network, resulting in financial loss.

(ii) Outline **one other** potential consequence of a phishing attack on a hospital.

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(Question 5 continued)

A bring your own device (BYOD) policy allows employees to use their own devices to access data on TaylorMade Healthcare's local area network (LAN) via the internet.

- (b) Outline **two** strategies that TaylorMade Healthcare could use to maintain security when employees use their own devices.

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- (c) Outline **two** advantages of a bring your own device (BYOD) approach compared with the hospital providing devices to employees.

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