Government of **Western Australia**
School Curriculum and Standards Authority

COMPUTER SCIENCE

ATAR course examination 2020

Marking key

Marking keys are an explicit statement about what the examining panel expect of candidates when they respond to particular examination items. They help ensure a consistent interpretation of the criteria that guide the awarding of marks.

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Section One: Short answer **40% (90 marks)**

Question 1 **(2 marks)**

State **one** reason why linear and iterative system development methodologies are both similar and different.

Description	Marks
States one similarity that links to system development methodologies	1
States one difference that links to system development methodologies	1
Total	**2**

Answers could include:

Similar
The two are similar because they are both designed to support the logical flow of a project from preliminary analysis to final evaluation. They contain many of the same steps, such as analysis, design and development.

Different
The two are different because in an iterative methodology, costs are not fully known upfront, which can cause budgeting issues. However, these problems can be solved and solutions tested along the way/during the design iterations which can reduce the number of problems in the final system.

Accept other relevant answers.

Question 2 **(2 marks)**

Describe the role of open systems in database interconnectivity.

Description	Marks
Describes the role of open systems in database interconnectivity	2
States superficial comments about the role of open systems in database interconnectivity	1
Total	**2**

Answers could include:

Open systems provide some combination of interoperability, portability or open standards.
Open systems are one method or standard by which a database may be connected to a website to allow it to be data-driven.
Open systems facilitate database interconnectivity by using APIs or standards such as ODBC.

Accept other relevant answers.

Question 3 **(3 marks)**

State **three** advantages of modularisation in the writing of software programs.

Description	Marks
One mark each for one to three valid advantages	1–3
Total	**3**

Answers could include:

- Modularisation allows different programmers to work on individual parts of a larger program, making program development quicker.
- Once a module has been created, it can be reused in other applications.
- Modularisation makes algorithms easier to understand
- Easier to debug.

Accept other relevant answers.

Question 4 **(3 marks)**

Explain the difference between full backups and incremental backups used in disaster recovery.

Description	Marks
Explains the difference between full backups and incremental backups used in disaster recovery	3
Explains the difference between full backups and incremental backups	2
Outlines some relevant facts about full backups and incremental backups	1
Total	**3**

Answers could include:

Full backups are complete copies of the data of a system. Such backups require storage media equal to the size of the data. Incremental backups are partial copies made since the last backup that consist of the differences between the two backup points or the data that was added since the last backup. Therefore in the event of a disaster, both backups provide an opportunity to restore data.

Accept other relevant answers.

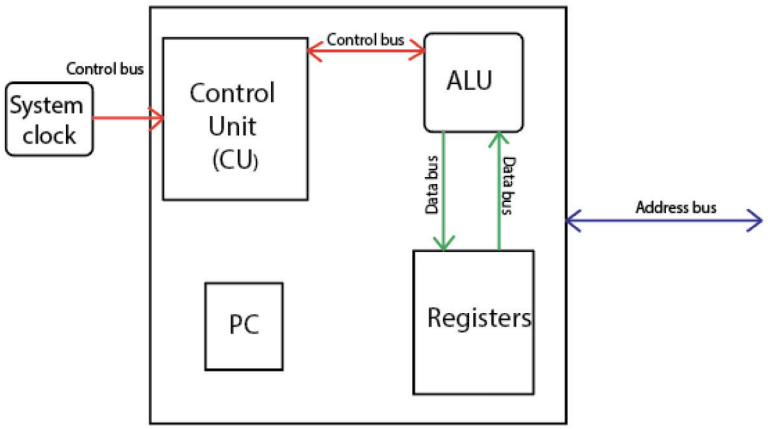
Question 5 **(8 marks)**

The components of the central processing unit (CPU) are the:
- arithmetic logic unit (ALU)
- control unit
- registers
- program counter
- system clock
- data, address and control bus.

Draw a diagram illustrating how these components are connected.

Description	Marks
Diagram contains eight correct components, connected correctly	8
Diagram contains seven correct components, connected correctly	7
Diagram contains six correct components, connected correctly	6
Diagram contains five correct components, connected correctly	5
Diagram contains four correct components, connected correctly	4
Diagram contains three correct components, connected correctly	3
Diagram contains two correct components, connected correctly	2
Diagram contains one correct component	1
Total	**8**

A sample diagram is below. System clock is external to the CPU and memory/input/output are outside the scope of the question.



Central processing unit components:
- arithmetic logic unit (ALU)
- control unit
- registers
- program counter
- system clock
- data
- address
- control bus.

Accept other relevant answers.

Question 6 **(2 marks)**

Processors with multiple cores are now widely used in computers because of the improved performance they offer. Describe how multiple cores offer improved system performance over single core processors.

Description	Marks
Describes how multiple cores improve system performance	2
States a superficial comment about multicore processing	1
Total	**2**

Answers could include:

A multicore processor is a unit which has two or more processors incorporated to increase performance. It allows for parallel processing to work, by simultaneously executing multiple tasks, thus allowing for enhanced system performance of software. There is less latency because the cores can communicate more quickly, as they're all on the same chip.

Accept other relevant answers.

Question 7 **(2 marks)**

Describe how an operating system manages memory.

Description	Marks
Describes how an operating system manages memory	2
States a superficial comment about an operating system managing memory	1
Total	**2**

Answers could include:

In multiprogramming, the OS decides the order in which processes are granted access to memory, and for how long. It allocates the memory to a process when the process requests it and deal locates the memory when the process has terminated or is performing an I/O operation.

Accept other relevant answers.

Question 8 **(2 marks)**

State **two** advantages for employees of a standard operating environment (SOE).

Description	Marks
States one to two valid advantages of a SOE	1–2
Total	**2**

Answers could include:

- employees can swop between devices
- when a problem occurs a technician can resolve the problem quickly
- creates a known, expected and supportable environment.

Accept other relevant answers.

Question 9 **(6 marks)**

Describe **three** legal obligations of developers when they are creating new software.

Description	Marks
Three legal obligations (x 2 marks each)	
Describes legal obligations of developers when creating new software	2
States a general comment about legal obligations of developers when creating new software	1
Total	**6**

Answers could include:

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Compliance: Software may need to comply with the Australian Privacy Principles.

Disclosure: Developers may need to provide an End User Licence Agreement for the software.

Accept other relevant answers.

Question 10 **(4 marks)**

Describe the following factors that affect the development of software:
- user needs
- technical specification.

Description	Marks
User needs	
Describes user needs in the context of software development	2
Makes superficial comments about user needs	1
Subtotal	**2**
Technical specifications	
Describes technical specifications in the context of software development	2
States a superficial comment about technical specifications	1
Subtotal	**2**
Total	**4**

Answers could include:

User needs: User needs drive the initial phases of software development. If the requirements are not correct, the users will not accept the software. Users should also have an opportunity to provide feedback during other phases (e.g. design).

Technical specifications: It is important to match the software to the hardware (hardware/software compatibility). If software is made that demands 8Gb of RAM and it is installed on a computer that has only 4Gb of RAM, there will be problems. When advertising the software, the technical specifications must be listed.

Accept other relevant answers.

Question 11 **(3 marks)**

Provide an example of each of the following simple data types used in programming. The first has been done for you.

Description	Marks
Integer: Any whole number	1
Real number: Any number with a decimal point	1
Boolean: True or False or any equivalent representation	1
Total	**3**

Question 12 **(10 marks)**

Below is an extract from a table currently used in a doctor's surgery.

(a) Using information from the table above, explain data redundancy. (2 marks)

Description	Marks
Data redundancy	
Describes data redundancy using the example	2
States a superficial comment about data redundancy	1
Total	**2**
Answers could include: Data redundancy can occur when storing the same field values more than once (unnecessarily). For example, if Hannah Chen changes her name, multiple occurrences need to be updated.	
Accept other relevant answers.	

(b) Normalise the data from the table on page 8 to 3NF definitions. Identify the entities, primary and foreign keys. (8 marks)

Description	Marks
Identifies the correct entities	1–3
Identifies the correct primary keys	1–3
Identifies the correct foreign keys	1–2
Total	**8**
Sample answer (does not need to include attributes): Patient (PatientID, PatientSName, PatientFName, DOB, Address, Suburb, Postcode) Appointment (AppointmentID, PatientID FK, DoctorID FK, AppointDate, AppointTime) Doctor (DoctorID, DocSName, DocFName)	
Accept other relevant answers.	

Question 13 **(3 marks)**

Consider the diagram below.

(a) Describe how this diagram assists a manager in executing a project. (2 marks)

Description	Marks
Describes how this diagram assists a project manager in executing a project	2
States a superficial comment about the diagram	1
Total	**2**

Sample answer

The PERT chart can be used by managers to ensure that the project is accurately scoped. The manager has a full view of the project before it is started and can then identify potential bottlenecks. They are best used for an overall view of the project dependencies and are not flexible enough to document small changes as the project evolves.

Accept other relevant answers.

(b) The diagram includes the critical path. Using this information, state how long the project will take to finish. (1 mark)

Description	Marks
11.5 days	1
Total	**1**

Question 14 **(5 marks)**

Consider the code below.

```
FUNCTION GetLicence (age)
licence ← False
IF age >= 16 THEN
        licence ← True
ELSE
        licence ← False
GetLicence ← licence
END FUNCTION

MODULE Main
LPlates ← False
age ← 0
INPUT (age)
LPlates ← GetLicence (age)
IF LPlates = True THEN
        OUTPUT('You are old enough to have L plates')
ELSE
        OUTPUT('You are not old enough to have L plates')
END MODULE Main
```

(a) Identify a parameter in the function. (1 mark)

Description	Marks
age	1
Total	**1**

(b) Identify a local variable in the module. (1 mark)

Description	Marks
Either LPlates, licence or age	1
Total	**1**

(c) Apart from good programming practice (declaring a variable before use), describe why LPlates does not need to be set to False at the beginning of the module. (2 marks)

Description	Marks
Describes why LPlates does not need to be set to False at the beginning of the module	2
States a superficial comment about setting the value of the variable.	1
Total	**2**
Answers could include: LPlates does not need to be set to any value at the start of the module because it is assigned the return value from the function GetLicence() before being evaluated in the Main module.	
Accept other relevant answers.	

(d) Identify the output in the module if the number 16 is input. (1 mark)

Description	Marks
You are old enough to have L plates	1
Total	**1**

Question 15 **(2 marks)**

Describe **one** way in which convergence has influenced the development of mobile devices.

Description	Marks
Describes one way convergence has impacted on the development of mobile devices	2
States a superficial comment about convergence	1
Total	**2**

Answers could include:

Digital convergence has brought together many functions in fewer devices, such as the smartphone. Computing power, telephony and Bluetooth technology, wireless connectivity, photograph, video and music capabilities, mobile viewing and listening, live television and health profiles can all be melded into one device. This impacts on mobiles by increasing processing power, battery capacity and access to applications that replace more discrete devices over time.

Accept other relevant answers.

Question 16 **(6 marks)**

Different database architectures have different strengths and weaknesses.

(a) Describe **one** difference between centralised and distributed databases. (2 marks)

Description	Marks
Describes a difference between centralised and distributed databases	2
States a superficial comment about centralised and distributed databases.	1
Total	**2**
Answers could include: A centralised database is located and stored in a single location. In contrast, a distributed database is spread across multiple locations. The former may suffer from bottlenecks more so than the latter, but the latter requires a more complex design.	
Accept other relevant answers.	

(b) State **one** example of where a distributed database would have an advantage over a centralised database. (1 mark)

Description	Marks
States an example of where a distributed database would have an advantage over a centralised database	1
Total	**1**
Answers could include: An advantage of a distributed database (over a centralised database) could be that users can work with specific (smaller) parts of the database because the database is split over multiple locations. Also accept performance or security concerns.	
Accept other relevant answers.	

(c) Consider a distributed database. Multiple clients each keep a local working copy of a database that is written back periodically to a master central copy. Using an example, explain **one** problem with this method. (3 marks)

Description	Marks
Explains a problem with distributed databases, using a simple example	3
Outlines some relevant facts about distributed databases	2
States a superficial comment about distributed databases or uses a simple example	1
Total	**3**
Answers could include: Depending on when the writes occur, the master copy could lose synchronisation, leading to potential integrity problems. For example, clients A and B both have a current local copy of record R. Client A changes R but does not write the change back to the master immediately. Client B changes R and writes back to the master. Client A then writes back to the master.	
Accept other relevant answers.	

Question 17 **(6 marks)**

Describe the role of the following devices in network communications:

- repeaters
- bridge
- network interface card.

Description	Marks
3 devices (repeaters/bridge/network interface card) x 2 marks each	
Describes the role of the device in network communications	2
States a general comment about the role of the device in network communications	1
Subtotal	**2**
Total	**6**

Answers could include:

Repeaters
Repeaters are placed at suitable locations in between the transmitter and the receiver. A repeater, picks up the signal from the transmitter, amplifies and retransmits it to the receiver sometimes with a change in carrier frequency.

Bridge
A bridge is a type of computer network device that provides interconnection with other network segments that use the same protocol.

Network interface card
A network interface card connects your device to a local data network or the Internet. The card translates device data into electrical signals it sends through the network; the signals are compatible with the network so computers can reliably exchange information.

Accept other relevant answers.

Question 18 **(9 marks)**

Network security often uses some form of authentication as the first level of protection

(a) List **two** advantages of using passwords to ensure the security of networks. (2 marks)

Description	Marks
Lists two advantages of using passwords to ensure the security of networks	2
Lists one advantage of using passwords to ensure the security of networks	1
Total	**2**
Answers could include: Passwords can be secure, because only the correct user knows it. Passwords can be stored in an encrypted form in a password manager.	
Accept other relevant answers.	

(b) List **two** disadvantages of using passwords to ensure the security of networks. (2 marks)

Description	Marks
Lists two disadvantages of using passwords to ensure the security of networks	2
Lists one disadvantage of using passwords to ensure the security of networks	1
Total	**2**
Answers could include: Long passwords are hard to remember. Passwords can be cracked.	
Accept other relevant answers.	

(c) List **two** other methods that could be used to authenticate a user to a networked computer. (2 marks)

Description	Marks
Lists two methods that could be used to authenticate a user to a networked computer	2
Lists one method that could be used to authenticate a user to a networked computer	1
Total	**2**
Answers could include: Biometric-based methods (e.g. fingerprints). Token-based methods (e.g. access cards).	
Accept other relevant answers.	

Question 18 (continued)

(d) Phishing is a popular strategy used to compromise the security of networks. Using an example, explain how phishing works. (3 marks)

Description	Marks
Phishing	
Explains phishing with an example	3
Identifies some relevant aspects of phishing	2
Makes superficial comments about phishing	1
Total	**3**
Answers could include: Phishing involves a criminal masquerading as someone else. This could be done in-person, by phone or by email. For example, an email could be delivered as spam (sent to many users) or sent to a specific person or persons (spear phishing). The email appears to be from a legitimate firm (e.g. a courier company or a bank) and asks the target to perform some action which appears legitimate (e.g. click on a link to check a password), usually with some urgency. The link actually performs another function which subverts security.	
Accept other relevant answers.	

Question 19 **(6 marks)**

Several factors influence the performance of a network, including data collisions and bandwidth.

(a) Describe how data collisions affect network performance. (2 marks)

Description	Marks
Describes how data collisions affect network performance	2
States a superficial comment about data collisions	1
Total	**2**
Answers could include: When two devices on a network try to communicate at the same time. Their signals collide with each other and the transmission fails. The devices attempt to re-transmit at a (usually) random interval. As more devices are added to a network segment, collisions increase and therefore performance is degraded.	
Accept other relevant responses	

(b) State **one** way in which data collisions can be reduced in an Ethernet network. (1 mark)

Description	Marks
States one way data collisions can be reduced in an Ethernet network	1
Total	**1**
Answers could include: Break the network into smaller segments with a switch.	
Accept other relevant responses	

(c) Describe the concept of bandwidth and its effect on performance. (2 marks)

Description	Marks
Describes the effect of bandwidth on performance	2
States a superficial comment about bandwidth	1
Total	**2**
Answers could include: The bandwidth of a communications channel is the amount of data that can be transmitted across the channel in a given period (often stated in bits per second). The greater the bandwidth, the better the performance. Also accept: bandwidth is a measure of the width of a frequency band.	
Accept other relevant responses	

(d) If a communications channel has a bandwidth of 10 Mbps, how long will it take to transmit a 25-megabyte file (assuming 8 bits to a byte)? (1 mark)

Description	Marks
20 seconds	1
Total	**1**
25 x 10^6 x 8 / 10 x 10^6 (25x8) / 10	

Question 20 **(3 marks)**

Using an example, explain the ethical implications of the use of data mining.

Description	Marks
Explains the ethical implications of the use of data mining with an example	3
Describes some relevant aspects of the ethical implications of the use of data mining	2
States a superficial comment about the ethics of data mining	1
Total	**3**

Answers could include:

The ethical implications revolve around informed consent. Users may have given consent for a specific use of their data, however data mining by its nature is effectively re-purposing the data, which may not be ethical. The use of personally-identifiable information (PII) is an example. You may provide this information to one body for a specific, agreed purpose, but that does not (ethically) give that body the right to re-use your PII for other purposes or to sell your PII to another party.

Accept other relevant answers.

Question 21 **(3 marks)**

Explain the difference between source code, byte code and executable code.

Description	Marks
Explains the difference between source code, byte code and executable code.	3
Describes some relevant facts about at least two of source code, byte code or executable code	2
States a superficial comment about source code, byte code or executable code	1
Total	**3**

Answers could include:

Source code is directly human-readable, byte code and executable code less so. Source code needs to be compiled to byte code or executable code before it can run on a machine. Source code is more portable than byte code, while byte code is more portable than executable code. Executable code runs faster than byte code.

Accept other relevant answers.

Section Two: Extended answer **60% (109 Marks)**

Question 22 **(35 marks)**

(a) In developing the system solution for Carpark Services, describe the following stages of the systems development life cycle (SDLC) and provide an example of an activity in each stage as it relates to the project. (6 marks)

Description	Marks
Three stages (2 x marks each)	
Describes the stage of the systems development life cycle (SDLC) and provide an example of each activity that is related to the project.	2
States a general comment about the stage of the systems development life cycle (SDLC) and provides an example of each activity that is related to the project.	1
Subtotal	**2**
Total	**6**
Answers could include: Preliminary analysis: the first stage of the SDLC initial analysis and findings of the system; where the problem is identified Example: the problem definition is the inefficiencies of having to employ a number of parking inspectors to check time cars have parked. Design: the third stage of the SDLC, is where the system is transformed based on the user requirements and the detailed analysis of a new system, Example: Data flow diagrams (DFDs) and Data Dictionaries are examples of the tools we could use to describe the system design. Implementation: the fourth stage of the SDLC where the the system design is converted into a functioning system and introduced into everyday use. Change over methods including direct cut, phased, pilot and parallel. Example: The old system was a manual one. With this project, an example of an implementation artefact would be the code that recognises the licence plates.	
Accept other relevant responses	

(b) Complete the level 0 Data Flow Diagram (DFD) for Carpark Services. (29 marks)

Description	Marks
Draws a Level 0 data flow diagram that features:	
Entities	
• MANAGER • BANK	1–2
Subtotal	**2**
Data stores (named appropriately) Vehicle data store	
• Maximum vehicle database • Cost Codes database	1–2
Subtotal	**2**

Question 22 (continued)

Processes (must include number and verb) 1.0 Record vehicle details already present, 2.0 Display message 'input licence no', 3.0 Allow entry details	
• 4.0 Update maximum vehicle database • 5.0 Display if carpark full • 6.0 Verify details • 7.0 Display amount owing • 8.0 Update exit details • 9.0 Update maximum vehicle details • 10.0 Collate report	1–7
Subtotal	**7**
1.0 Record vehicle details	
Appropriate data flow/s in: licence details Appropriate data flow/s out: time, date, recorded licence details Appropriate data flow/s out: time, date, recorded licence details	
2.0 Display message 'input licence no'	
Appropriate data flow/s in: unrecorded licence details, licence details	1
Appropriate data flow/s out: input licence message details, inputted licence details	1
3.0 Allow entry details	
Appropriate data flow/s in: vehicle licence details	1
Appropriate data flow/s out: entry details	1
4.0 Update maximum vehicle database	
Appropriate data flow/s in: entry details, exit details	1
Appropriate data flow/s out: vehicle entry details	1
5.0 Display if carpark full	
Appropriate data flow/s in: updated details	1
Appropriate data flow/s out: full or available parking details	1
6.0 Verify details	
Appropriate data flow/s in: licence details, vehicle details	1
Appropriate data flow/s out: verified details	1
7.0 Display amount owing	
Appropriate data flow/s in: verified details, cost code details,	1
Appropriate data flow/s out: Amount owing details	1
8.0 Update exit details	
Appropriate data flow/s in: payment details, vehicle details, confirmed card details	1
Appropriate data flow/s out: credit card details, updated exit details, exit details	1
9.0 Update maximum vehicle details	
Appropriate data flow/s in: updated exit details	1
Appropriate data flow/s out: updated vehicle exit details	1
10.0 Collate report	
Appropriate data flow/s in: updated vehicle exit details	1
Appropriate data flow/s out: report details	1
Subtotal	**18**
Total	**29**
Note to markers: Can use fewer or more processes, as long as logic is clear and works. The Data Flow Diagram is just one example of a DFD that could be drawn for Carpark Services. Accept other relevant DFDs.	
Accept other relevant responses	

Question 23 **(20 marks)**

(a) Using Chen's notation, draw an Entity Relationship (ER) diagram that includes the following:

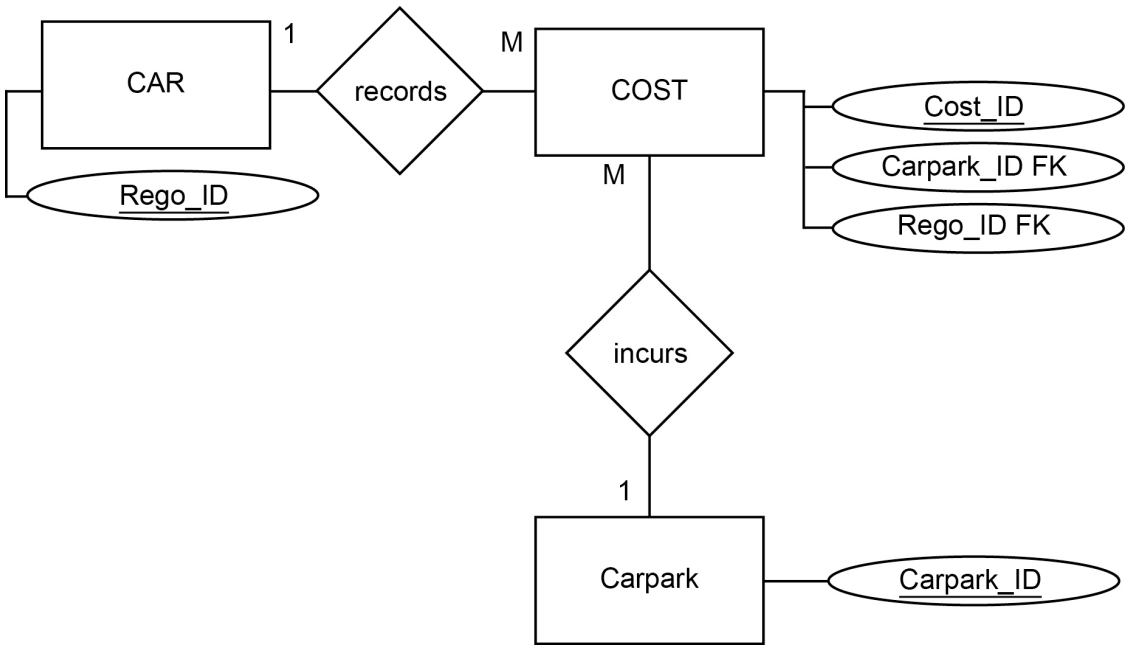
- names of all primary keys
- names of all foreign keys
- relationships
- cardinality.

You need to resolve all many-to-many relationships. (13 marks)

Description	Marks
Draws a relevant ER diagram for the given context that includes:	
Chen notation	
Uses Chen's notation appropriately	1
Subtotal	**1**
Entities, relationships and cardinalities	
Identifies all three entities, two relationships and two cardinalities correctly	7
Identifies any six (combination of entities, relationships and cardinalities) correctly	6
Identifies any five (combination of entities, relationships and cardinalities) correctly	5
Identifies any four (combination of entities, relationships and cardinalities) correctly	4
Identifies any three (combination of entities, relationships and cardinalities) correctly	3
Identifies any two (combination of entities, relationships and cardinalities) correctly	2
Identifies one entity, relationship or cardinality correctly	1
Subtotal	**7**
Primary keys (appropriate to entities)	
One mark for each primary key identified correctly. Maximum three marks. Note: allow for the inclusion of composite key(s) for an associative entity.	1–3
Subtotal	**3**
Foreign keys (appropriate to entities)	
Each foreign key (or composite keys) identified correctly. Maximum two marks.	2
Subtotal	**2**
Total	**13**

Question 23 (continued)

Note: Consider the candidate's interpretation of the given context and the ER diagram they have drawn. Possible solution below.



Accept other relevant responses that fit the ER logic.

(b) Refer to your ER solution in part (a) and write a query using Structured Query Language (SQL) that will display the Rego_ID, entry and exit time of cars that were parked for three hours or more, and have been charged more than $10 for parking.

- Rego_ID
- Entry_time
- Exit_time
- Actual_Cost (4 marks)

Description	Marks
SELECT, FROM, WHERE used correctly	1
Correct tables referenced	1
Correct fields referenced	1
Conditions met	1
Total	**4**

```
SELECT Rego_ID, Entry_time, Exit_time, Actual_Cost
FROM Cost
WHERE Exit_time – Entry_time >= 180
        AND Actual_Cost > 10
```

Accept other relevant responses, specific to particular database implementations.

(c) Using the above as an example, explain the difference between 2NF and 3NF. (3 marks)

Description	Marks
Explains 2NF and 3NF with an example	3
Gives some features of 2NF and 3NF	2
Superficial or general comments regarding 2NF and 3NF used	1
Total	**3**

Possible response below.

2NF is usually used in tables with a multiple-field primary key. It is also where each non-key field relates to the entire primary key. Second normal form also occurs when any field that doesn't relate to the primary key is in a separate table.

A relation is in 3NF is it contains no repeating groups, no partial functional dependencies, and no transitive functional dependencies. It is usually used in tables with a single-field primary key. In the carpark data, the Rego_ID is the primary key for the CAR table, as each car has its own unique license registration number. Third normal form records do not depend on anything other than a table's primary key. It is where each non-key field is a fact about the key. Values in a row that are not part of that row's key do not belong in the table, and in 3NF they are not there. Third normal form is the final form of normalisation and is the goal for any normalisation that takes place.

Accept other relevant responses.

Question 24 **(23 marks)**

(a) Using the pseudocode on page 22, complete the trace table below to calculate the check digit for the RN '123'. (8 marks)

Description	Marks
Completes the trace table correctly.	
One mark for each correct line	1–8
Total	**8**

Line#	Hundreds	Tens	Ones	Sum	CheckDigit
1	0				
2		0			
3			0		
4	1				
5		6			
6			21		
7				28	
8					8

(b) When a ticket is issued, it is time-stamped with a marker that is the time in minutes since the system was started. Write a function to calculate the time (in minutes) spent by a customer in the car park. Use the ticket issue time as a parameter. Assume that there is a library function you can use, called NOW(), that returns the current time in minutes since the system was started. (6 marks)

Description	Marks
Writes a function in pseudocode that features:	
Function keyword and name	1
use of the entry time as a parameter	1
correct computation of time	1
correct use of library function	1
assignment of final value to function	1
closure of function.	1
Total	**6**

Sample solution

```
FUNCTION CalcTime (entry)
current ← 0
diff ← 0
current ← NOW()
diff ← current - entry
CalcTime ← diff
End FUNCTION
```

(c) Using the information below, write a function to calculate the cost of a ticket, given the time spent in the car park. You may wish to use the function you defined in part (b) on page 23 to help you.

- The first hour is free.
- The second hour is a single charge of $5.
- Between 3–24 hours (inclusive) the cost is $3 per hour (including the first two hours). After 24 hours, there is a single charge of $100.

Assume that there is a library function you can use, called INT(), that returns the integer part of a real (floating point) number. For example, INT(0.5) returns 0 (zero), INT(1.0) returns 1 and INT(2.9) returns 2. Remember that there are 60 minutes in an hour.

(9 marks)

Description	Marks
Writes a function in pseudocode that features:	
Function keyword and name	1
use of the ticket time as a parameter	1
correct use of function defined in part (b) or another suitable function name if (b) not attempted or code that computes the equivalent value	1
correct computation of cost	1–4
assignment of final value to function	1
closure of function.	1
Total	**9**

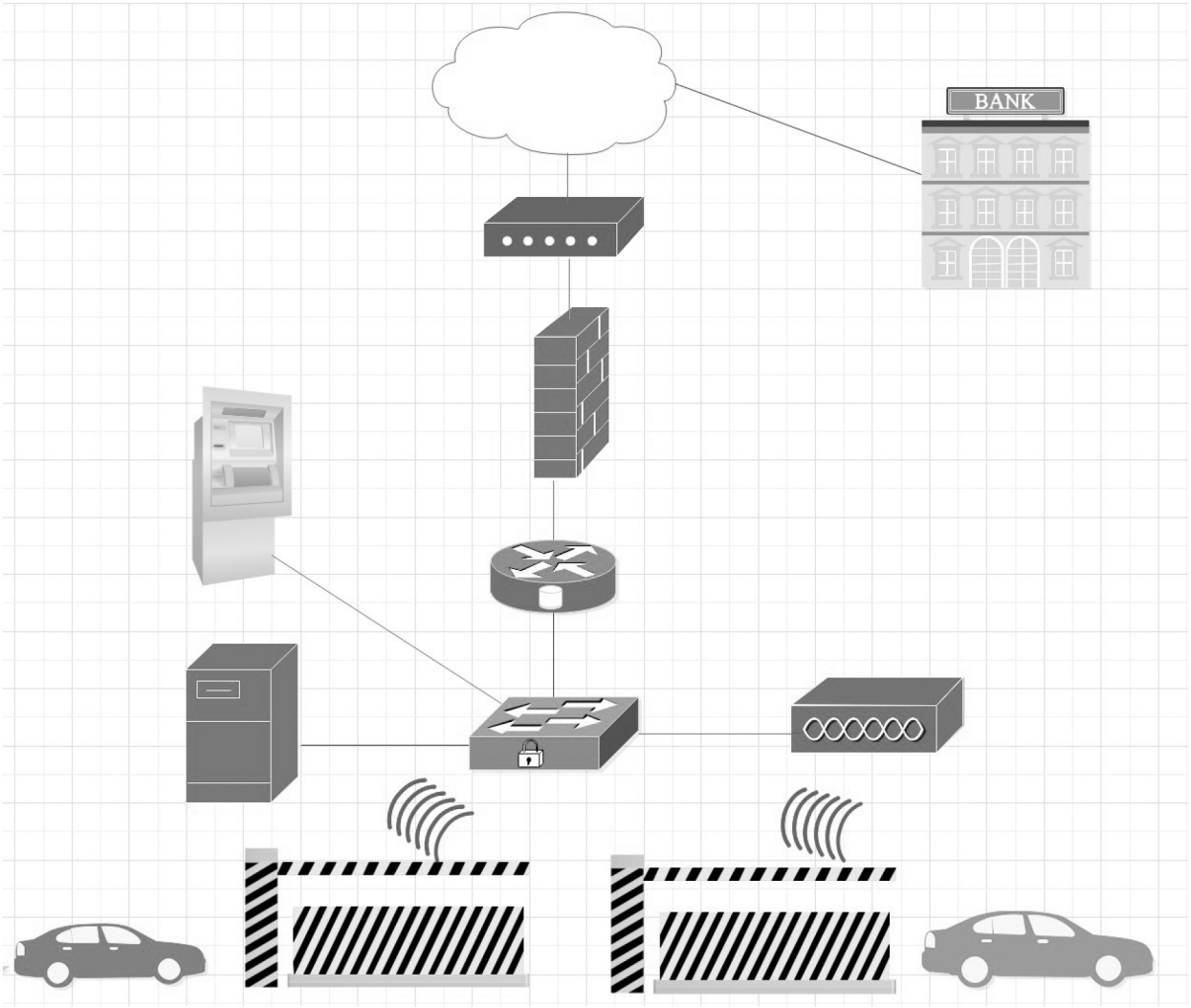
Sample solution

```
FUNCTION CalcCost (ticket_time)
cost ← 0
spent ← CalcTime(ticket_time)
CASE spent OF
    <= 60    : cost ← 0
    <= 120   : cost ← 5
    <= 1440 : cost ← INT(spent/60) * 3
    >  1440  : cost ← 100
END CASE
CalcCost ← cost
End FUNCTION
```

Note to markers: Accept other selection structures in place of CASE.

Question 25 **(31 marks)**

(a) Draw the network diagram for the Carpark Services system which incorporates a payment machine. Include the following network devices and components: Router, Switch, Firewall, Modem, Server, Wireless Access Point. (13 marks)



Description	Marks
Provides a viable solution with sequencing of devices for the Carpark Services connection Appropriate order of components For example: Wireless Access Point to switch to barrier gate, server to switch, Wireless Access Point to Switch, Payment Machine to switch, switch to router, router to modem, modem to firewall, modem to cloud to bank	1–9
Separation of entry and exit or micro controller	1
Appropriate use of CISCO conventions for up to three devices	3
Total	**13**
Accept any other reasonable answers.	

(b) Describe **two** methods that can be used to ensure the security of the Carpark Services network. (4 marks)

Description	Marks
Two methods (x 2 marks each)	
Describes a method that can be used to ensure the security of the Carpark Services network	2
Provides some relevant facts about a method that could be used to enhance the security of the Carpark Services network	1
Subtotal	**2**
Total	**4**

Answers could include:

Encryption could be used at the source and destination nodes on a network or could be used during transport. The source/destination scenario assumes that the parties have a shared secret key or a public/private key pair each. The 'during transport' scenario means that end-user applications do not have to be altered as the encryption occurs at the lower layers.

A firewall is a network security system that monitors and controls incoming and outgoing network traffic, based on predetermined security rules. A firewall typically establishes a barrier between a trusted internal network and an untrusted external network, such as the Internet.

Authentication provides access control for network systems by checking to see if a device's credential match a stored credential thereby ensuring that only authorised devices are recognised on the network.

Accept other relevant answers.

Question 25 (continued)

(c) For Carpark Services to be able to store its information in the cloud, it requires the use of the Department of Defence (DoD) transmission control protocol/internet protocol (TCP/IP) model. Identify and describe the **four** layers of DoD (TCP/IP), using examples from Carpark Services. (12 marks)

Description	Marks
Four layers (x 3 marks each)	
Identifies the layer and describes what happens in the layer of TCP/IP in regards to this system	3
Identifies the layer and provides some relevant facts about what happens in the layer of TCP/IP in regards to this system	2
Identifies the layer or makes superficial comments about what happens in each layer of TCP/IP.	1
Subtotal	**3**
Total	**12**

Answers could include:

The application layer is the group of applications that require network communication. This includes interaction with the application, data translation and encoding, dialogue control and communication coordination between systems. For example, when a customer inputs payment information.

The transport layer provides a reliable data connection between two devices. It divides the data into packets, acknowledges the packets that it has received from the other device, and makes sure that the other device acknowledges the packets it receives. For example, ensuring quality of service when connecting to the bank.

The internet layer (also called the network layer) controls the movement of packets around the network. For example connection between router and the bank's network.

The network layer (also called the data link layer or physical layer) handles the physical parts of sending and receiving data using an Ethernet cable, wireless network, network interface card, device driver in the computer, and so on. For example, connection between a Wireless Access Point and switch.

Accept other relevant answers.
Note: There are different names for the same layers.

(d) Describe how checksums can be used to assure the integrity of the Carpark Services wireless network traffic. (2 marks)

Description	Marks
Describes how checksums can be used to assure the integrity of the Carpark Services wireless network traffic	2
Makes superficial comments about checksums	1
Total	**2**

Answers could include:

A checksum is the result of a hash (or other function) computed on a data packet. The checksum is usually sent with the data packet. The checksum of the data packet can be re-computed at the destination and cross-checked. If a data error occurs in transmission, the corrupted packet can be re-requested and re-transmitted.

Accept other relevant answers.

ACKNOWLEDGEMENTS

Question 9 Answer adapted from: Vassallo, T. (2017). *A checklist for key issues in software development agreements*. Retrieved August, 2020, from https://www.mdplaw.com.au/insights-publications/software-development-agreement

Question 25(b) Paragraph 2 from: Firewalling (computing). (2020). In *Wikipedia*. Retrieved August, 2020, from https://en.wikipedia.org/wiki/Firewall_(computing)
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Question 25(c) Answer from: Fisher, S. (2019). *What is TCP/IP and how does it work?* Retrieved August, 2020, from https://www.avast.com/c-what-is-tcp-ip

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