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

WACE
Western Australian Certificate of Education

Western Australian Certificate of Education Examination, 2015

Question/Answer Booklet

COMPUTER SCIENCE

Stage 3

Please place your student identification label in this box

Student Number: In figures | | | | | | | | | |

In words _____

_____

Time allowed for this paper

Reading time before commencing work: ten minutes
Working time for paper: three hours

Materials required/recommended for this paper

To be provided by the supervisor

This Question/Answer Booklet
Source Booklet

Number of additional answer booklets used (if applicable): ☐

To be provided by the candidate

Standard items: pens (blue/black preferred), pencils (including coloured), sharpener, correction fluid/tape, eraser, ruler, highlighters

Special items: non-programmable calculators approved for use in the WACE examinations, Mathomat and/or Mathaid and/or any system flowchart template

Important note to candidates

No other items may be taken into the examination room. It is **your** responsibility to ensure that you do not have any unauthorised notes or other items of a non-personal nature in the examination room. If you have any unauthorised material with you, hand it to the supervisor **before** reading any further.

 Ref: 15-027

2016/1701
Web version of 2015/98530

Structure of this paper

Section	Number of questions available	Number of questions to be answered	Suggested working time (minutes)	Marks available	Percentage of exam
Section One: Short answer	20	20	70	64	40
Section Two: Extended answer	4	4	110	83	60
				Total	100

Instructions to candidates

1. The rules for the conduct of Western Australian external examinations are detailed in the *Year 12 Information Handbook 2015*. Sitting this examination implies that you agree to abide by these rules.

2. Write your answers in the spaces provided in this Question/Answer Booklet. A blue or black ballpoint or ink pen should be used. Wherever appropriate, fully labelled diagrams, tables and examples should be used to illustrate and support your answers.

3. You must be careful to confine your responses to the specific questions asked and to follow any instructions that are specific to a particular question. Where no specific instructions are given, you should feel free to use a range of formats to express your knowledge and understandings.

4. Spare pages are included at the end of this booklet. They can be used for planning your responses and/or as additional space if required to continue an answer.
   - Planning: If you use the spare pages for planning, indicate this clearly at the top of the page.
   - Continuing an answer: If you need to use the space to continue an answer, indicate in the original answer space where the answer is continued, i.e. give the page number. Fill in the number of the question that you are continuing to answer at the top of the page.

5. The Source Booklet is **not** to be handed in with your Question/Answer Booklet.

See next page

Section One: Short answer **40% (64 Marks)**

This section contains **20** questions. You must answer **all** questions. Write your answers in the spaces provided.

Spare pages are included at the end of this booklet. They can be used for planning your responses and/or as additional space if required to continue an answer.

- Planning: If you use the spare pages for planning, indicate this clearly at the top of the page.
- Continuing an answer: If you need to use the space to continue an answer, indicate in the original answer space where the answer is continued, i.e. give the page number. Fill in the number of the question that you are continuing to answer at the top of the page.

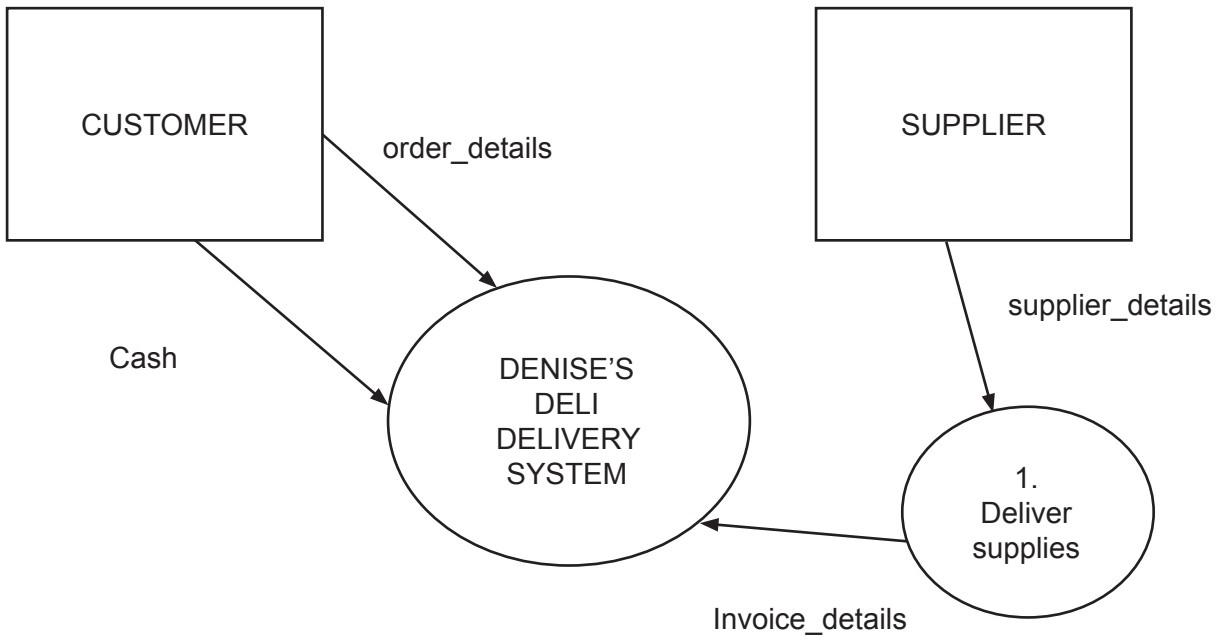
Suggested working time: 70 minutes.

Question 1 **(1 mark)**

State the purpose of a system boundary in the Analysis phase of the System Development Life Cycle.

Question 2 **(2 marks)**

In the Context Diagram below circle **two** elements that are drawn incorrectly.



Question 3 **(3 marks)**

State the difference between system and user documentation. Give **one** example of each to justify your answer.

Difference: _____

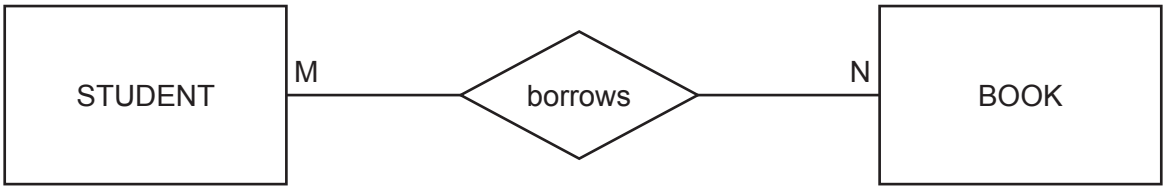
_____

System documentation example: _____

User documentation example: _____

Question 4 **(4 marks)**

A student creates the following Entity Relationship (ER) diagram for a new database.



(a) What is the issue with this? (1 mark)

_____

(b) Redraw the diagram to resolve this issue, showing the correct cardinality. (3 marks)

Question 5 **(1 mark)**

What is a network (per seat) licence?

Question 6 **(1 mark)**

What is an enterprise licence?

Question 7 **(2 marks)**

To record book loans, a high school librarian makes entries in a flat file database as follows:

Student name	Form
John Smith	9.01
Mary Jones	10.02
John Smith	9.01
Brian Clark	11.03
Jane Doe	8.02

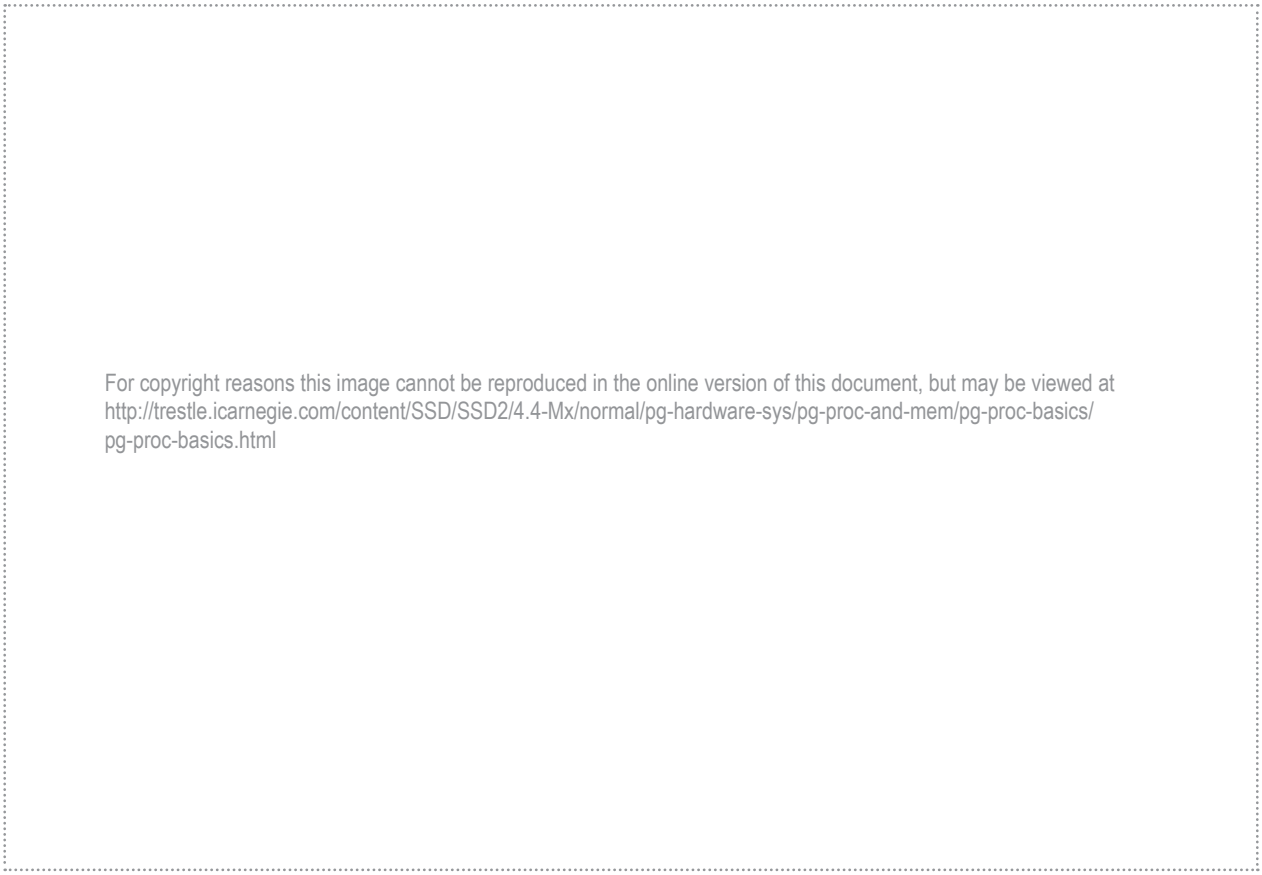
(a) Give **one** example of data redundancy in the above database. (1 mark)

(b) What process should be used to eliminate the data redundancy from the database? (1 mark)

See next page

Question 8 **(4 marks)**

The Fetch Execute Cycle for adding two numbers is shown below.



Fill in the correct terms in the spaces provided below to explain the above diagram.

Step 1 – The Control Unit _____ the instruction from Memory.

Step 2 – The Control Unit _____ the instruction and sends the two numbers to the ALU.

Step 3 – The ALU _____ the instruction to add the two numbers in Registers 1 and 2 and to store the result in the Accumulator.

Step 4 – The result is _____ back in Memory.

See next page

Question 9 **(2 marks)**

The following pseudocode calculates a pass or fail based on an average score. If the average is 50 or greater, a pass is recorded.

Identify **two** logic errors in the pseudocode.

```
Begin
        Score ← 0
        Bonus ← 0
        Count ← 0
        Total  ← 0
        Pass  ← False

        REPEAT
            For Count = 0 to 0
                Total ← Score + Bonus
            End For
        UNTIL Bonus = 10

        Average ← Total / Count
        If Average > 49 Then
            Pass ← True
        End If
End
```

One: _____

Two: _____

Question 10 **(1 mark)**

What is the function of a modem?

_____

_____

Question 11 **(1 mark)**

What is the function of a router?

_____

_____

See next page

Question 12 **(5 marks)**

Use the following table to create a Gantt chart in the space provided below to represent the project.

Activity	Start	Finish
Market research	Week 1	Week 4
Client surveys	Week 3	Week 5
System design	Week 6	Week 8
Coding	Week 8	Week 10
Testing	Week 9	Week 12

See next page

Question 13 **(3 marks)**

In developing programs, there are three types of code:

- source
- byte
- executable.

Match the type to the correct explanations.

Type of code	Explanation
	code that is used by a specific type of CPU
	code that is used to generate object code
	code that is designed to run virtual machines on different platforms

Question 14 **(2 marks)**

Give **one** advantage and **one** disadvantage of using satellites for data communications as compared to wired networks.

Advantage:

Disadvantage:

See next page

Question 15 **(4 marks)**

Consider the following pseudocode and answer the questions below.

```
Module TestAge (Tage, Tlicence)
        If Tage > 16 then
            Tlicence ← True
        Else
            Tlicence ← False
        End If
End Module

Module Main
        Input (age)
        TestAge (age, licence)
        If licence = True then
            Output ('You are old enough to have a licence')
        Else
            Output ('You are not old enough to have a licence')
        End If
End Module Main
```

(a) Provide **one** example of a formal parameter. (1 mark)

(b) Provide **one** example of an actual parameter. (1 mark)

(c) What data type is Tlicence? (1 mark)

(d) Which parameter is an example of passing by reference? (1 mark)

See next page

Question 16 **(6 marks)**

Complete the table below by providing an example of a suggested transmission medium, and a reason for your selection of that medium.

Transmission needed	Transmission medium suggested	Reason for selection
a connection to the file server within 50 metres		
a national company linking to branches within the same State		
a university on a single campus with a combination of desktops and laptops used by staff and students		

See next page

Question 17 **(6 marks)**

A person has been offered a job in which they will commence with a wage of 1 cent for the first week. The wage will then double each week. For example:

Week	Weekly wage
1	1 cent
2	2 cents
3	4 cents

Create an algorithm that will calculate the weekly wage that the person will receive in week 52.

Your algorithm must use only **one** method of iteration.

See next page

Question 18 **(4 marks)**

Consider the following pseudocode and answer the question below.

```
Begin
        Input (Wage)
        If Wage < 10 then
              Age ← 'Junior'
        Else
              If Wage <= 20 then
                    Age ← 'Middle'
              Else
                    If Wage > 20 then
                          Age ← 'Senior'
                    End If
              End If
        End If
        Output (Age)
End
```

Rewrite the pseudocode to use a 'case' statement.

See next page

Question 19 **(10 marks)**

The following database table is used by an online store to record the distributors of the movies and movie purchases by customers.

CustomerID	Surname	Firstname	MovieID	Movie	Distributor
14211	Black	Susan	GAJ1	Galaxy Journey	Sony
14211	Black	Susan	FRF1	Friends Forever	Universal
14390	Ng	Lam	GAJ1	Galaxy Journey	Sony
14390	Ng	Lam	SUM4	Super Mouse IV	20th Fox
14390	Ng	Lam	LOP1	Lost in Peru	Universal
14487	Green	Brad	GAJ1	Galaxy Journey	Sony
14487	Green	Brad	FRF1	Friends Forever	Universal

Normalise the data from the table above to 3NF.

- Create extra key fields as necessary.
- Underline primary keys and write 'FK' next to any foreign key or keys.

The customer entity has been provided for you.

CUSTOMER (CustomerID, Surname, Firstname)

See next page

Question 20 **(2 marks)**

Name **one** method that can be used to detect and correct errors in the transmission of data. Describe what should occur if an error is detected and requires correction.

Method:

Description:

End of Section One

See next page

Section Two: Extended answer **60% (83 Marks)**

This section has **four (4)** questions. Answer **all** questions. Write your answers in the spaces provided.

Spare pages are included at the end of this booklet. They can be used for planning your responses and/or as additional space if required to continue an answer.

- Planning: If you use the spare pages for planning, indicate this clearly at the top of the page.
- Continuing an answer: If you need to use the space to continue an answer, indicate in the original answer space where the answer is continued, i.e. give the page number. Fill in the number of the question that you are continuing to answer at the top of the page.

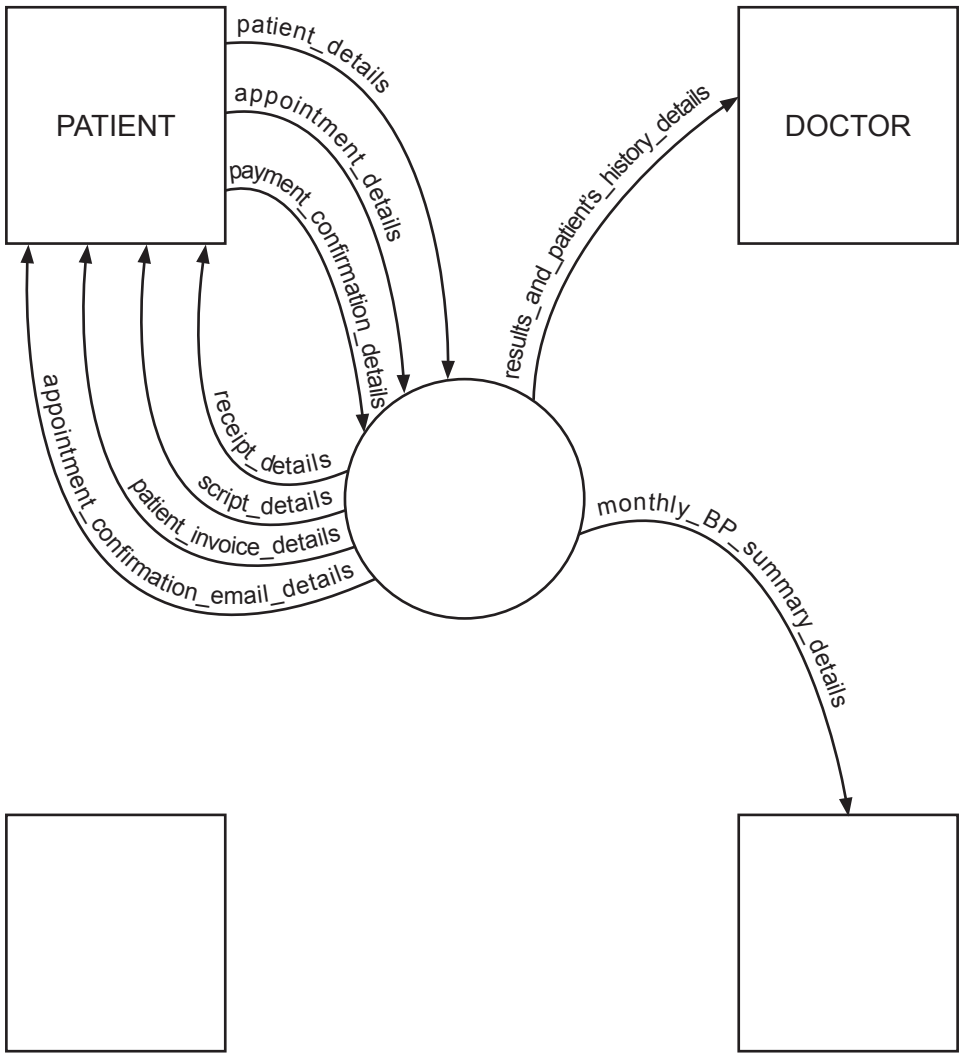
Suggested working time: 110 minutes.

Question 21 **(24 marks)**

You will need to refer to the description on page 2 of the **Source Booklet** to answer this question.

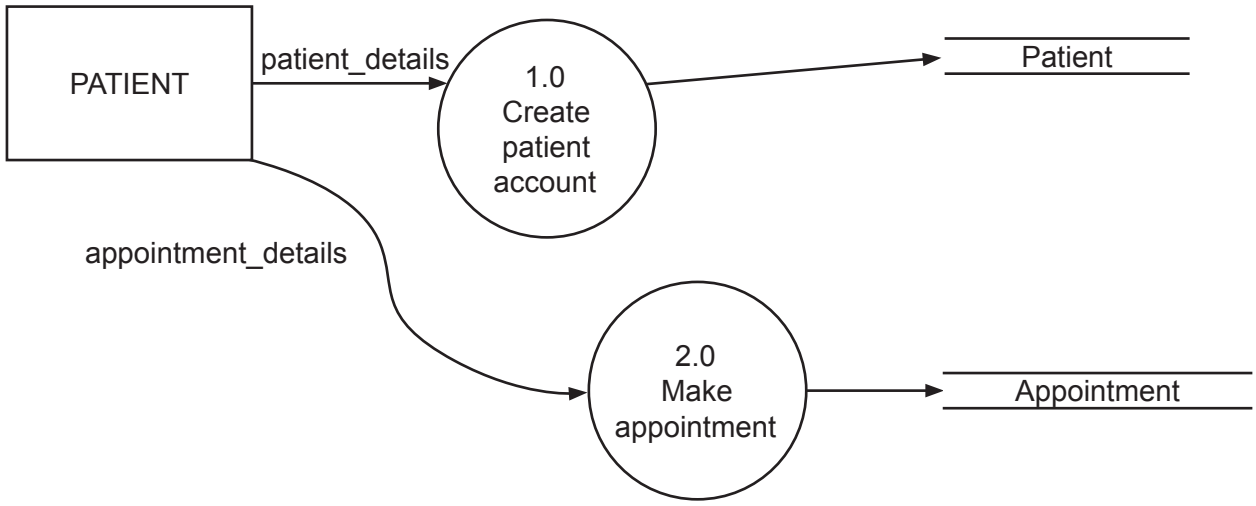
(a) Complete the Context Diagram below for the medical practice's patient record system. (7 marks)

Context Diagram



See next page

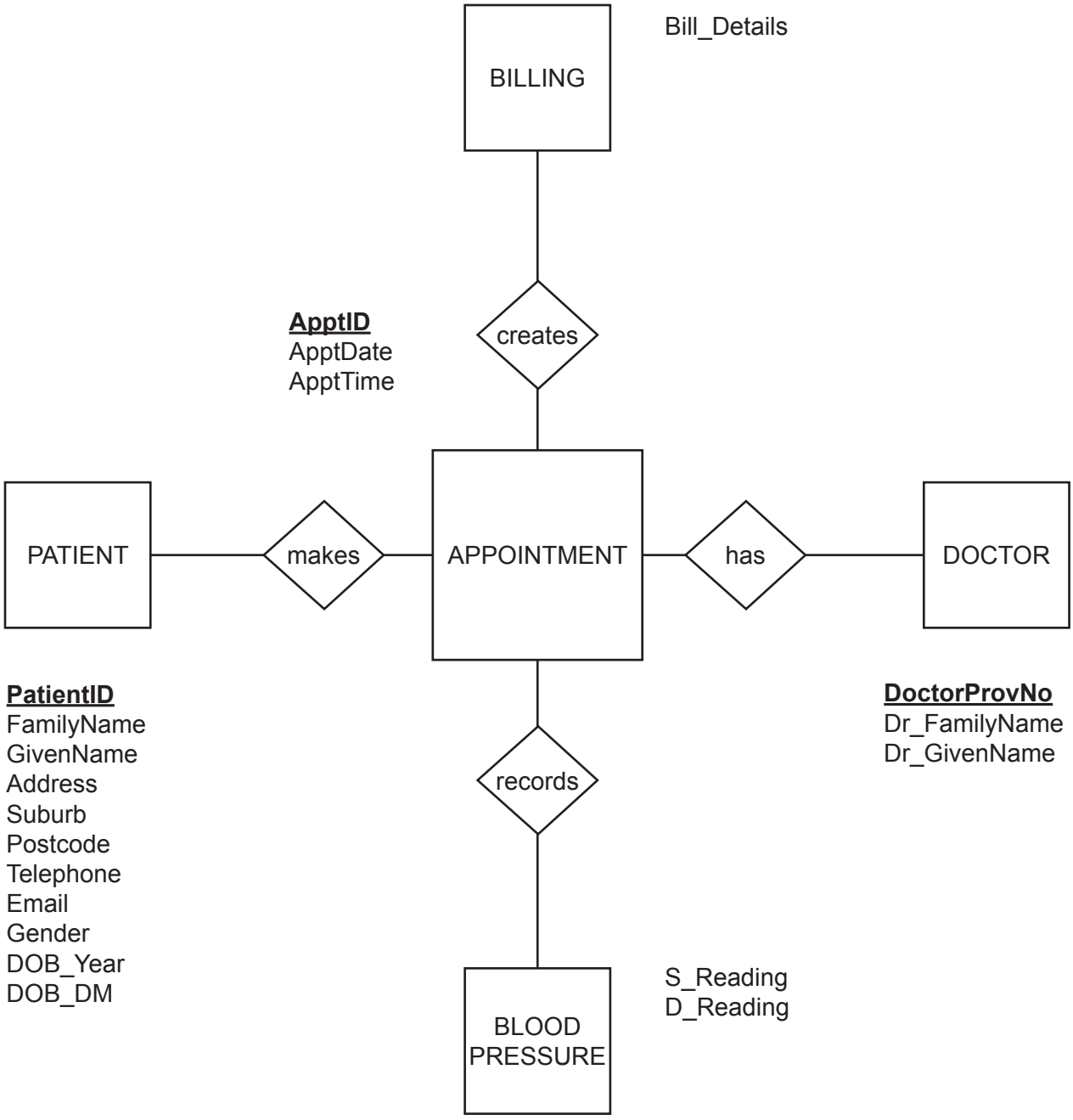
(b) Complete the following Level 0 Data Flow Diagram (DFD) for the medical practice's patient record system. (17 marks)



See next page

Question 22 **(27 marks)**

The incomplete Entity Relationship (ER) diagram (below) is based on the description provided on page 2 of the **Source Booklet**. Use this diagram to answer parts (a), (b) and (c).



See next page

(a) Complete the cardinality for the ER diagram. (4 marks)

(b) Complete foreign keys for the following entities: Billing, Appointment and Blood Pressure. (4 marks)

(c) As a result of the appointment, the doctor may decide to refer the patient to another doctor for further investigation. To achieve this, the medical practice has decided to add a Referral Database (Entity).

(i) Draw the Referral Entity on the ER diagram on page 18, showing the relationship and cardinality. (4 marks)

(ii) On the ER diagram list any primary or foreign keys that will be necessary for the Referral Entity. (2 marks)

(d) There are three types of integrity associated with data in a database: (3 marks)

- referential integrity
- domain integrity
- entity integrity.

Match each to the definition in the table below.

Type of data integrity	Definition
	ensures that there are no duplicate records in a table
	ensures that a value in a foreign key exists in its corresponding primary key table
	ensures that a value in an attribute lies within a range of given values

See next page

Question 22 (continued)

(e) Using the table on page 3 of the **Source Booklet** complete the Patient records Data Dictionary below by filling in each blank space. (6 marks)

Patient records				
Element name	**Data type**	**Size/ Format**	**Description**	**Constraint**
PatientID	Number	6		Required. Automatically created when record added
GivenName	String	25	Given name of patient (e.g. Barry)	Required
FamilyName	String	25	Surname of patient (e.g. Boan)	Required
Address	String	30	The street address of patient	Required
Suburb	String	30	The suburb where the patient lives	Required
Postcode	String		Postcode of patient	
Telephone	String	10	Telephone number of patient	Required
Email	String	30	Email address	Required, as email confirmation is given for appointment
Gender	String	6	Gender of patient	Required, Male or Female are the only choices
DOB_Year		N/A	Year of birth	Required
DOB_DM		5	Date of Birth Day and Month (e.g. 30/07)	

See next page

(f) Referring to the data provided on page 20, use Structured Query Language (SQL) to write a query to list the following: (4 marks)

- PatientId
- GivenName
- FamilyName.

For patients

- born after 1990 and
- whose postcode is 6502.

See next page

Question 23 **(20 marks)**

Consider the following information to answer the questions that follow.

A medical practice must ensure that data stored in a patient record is error-free. To assist in preserving data integrity, they use a check digit.

The check digit is calculated using the following algorithm:

- Take the hundreds digit of a blood pressure reading (BPR) and multiply by 1.
- Take the tens digit of a BPR and multiply by 3.
- Take the ones digit of a BPR and multiply by 7.

The check digit is the sum of the above three values. If the sum added is 10 or more, then the following function would be applied:

Function Mod(x, y) returns the integer remainder after x is divided by y.

For example, if the sum of the three numbers is equal to 22, then the function would look like this:

Mod(22,10) which returns a remainder of 2, i.e. 2 × 10 = 20 with 2 remaining.

Therefore the CheckDigit result would be: 2

The reading is stored in three integer variables called Reading[1], Reading[2] and Reading[3], starting with Reading[1], which is the hundreds digit.

```
Module GetBloodPressureReading

Begin
1       Hundreds← 0
2       Tens← 0
3       Ones ← 0
4       Hundreds ←Reading[1]
5       Tens ←Reading[2] * 3
6       Ones ←Reading[3] * 7
7       Sum←Hundreds + Tens + Ones
8       CheckDigit ←Mod(Sum,10)
End
```

See next page

(a) For the blood pressure reading ‘124’, the check digit is calculated to be 5. Complete the trace table below to test the logic of the algorithm, and determine whether or not the check digit has been calculated correctly. (8 marks)

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

Circle the answer:

The check digit has been calculated

correctly incorrectly.

See next page

Question 23 (continued)

(b) Use the space provided on page 25 to write an algorithm in pseudocode to do the following: (9 marks)

Read in the blood pressure readings.
Separately **sum** each type of these blood pressure readings.
Compute an **average** blood pressure for each type of reading.

An example of blood pressure readings for one patient would look like this:

SValue = 120, 140, 134, 0.
DValue = 80, 75, 82, 0.

A zero (0) reading indicates no more readings to come, and is not included in the calculation of the average value.

Some hints for developing your pseudocode have been provided for you below:

- initialise the variables
- using an iteration control structure of your choice, read in the DValues
- using an iteration control structure of your choice, read in the SValues
- calculate the sum of the DValues
- calculate the average of the DValues
- calculate the sum of the SValues
- calculate the average of the SValues.

See next page

Question 23 continues on the next page

See next page

Question 23 (continued)

(c) For insurance purposes, it is a requirement that if any SValue in part (b) is greater than 180, an alarm message must be output.

Write the pseudocode needed to add this requirement to the pseudocode that you developed in part (b). (2 marks)

(d) Where exactly, in the pseudocode that you developed in part (b), should the pseudocode from part (c) be placed in order to produce the expected output? (1 mark)

Question 24 **(12 marks)**

(a) All the information of the databases are stored on a centralised server located in the administration section. The blood pressure device transmits the reading via Bluetooth to the doctor's computer. This data is then transmitted to the central database, using an ethernet network.

Explain why the data is not transmitted directly from the blood pressure device using Bluetooth to the central database. (2 marks)

(b) Currently all of the rooms in the medical practice have STP cabling to enable doctors and staff to connect via wired Ethernet 802.3 protocol. They are considering implementing a wireless Ethernet 802.11x protocol throughout the medical practice.

What communications hardware would be required to implement wireless throughout the medical practice? (1 mark)

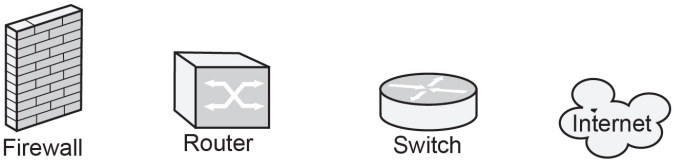
See next page

Question 24 (continued)

(c) The medical practice is considering forming a WAN with another medical practice to share patient data. Use the following symbols to construct a diagram of this WAN.

(3 marks)

A workstation for each medical practice has been provided for you.



Draw your diagram below the line.

Medical practice one

Medical practice two

See next page

(d) Each medical practice would need to take precautions against phishing. List **two** strategies that could be used. (2 marks)

One:

Two:

Each medical practice has agreed to maintain the patient records on their own database servers, allowing the other medical practices access to the patient databases.

(e) If the medical practices agree to maintain the blood pressure readings and share the patient data between the medical practices, this would be an example of data warehousing that could lead to data mining.

(i) What is data mining? (1 mark)

(ii) Name **one** ethical issue in data mining. (1 mark)

Question 24 (continued)

(f) One medical practice has suggested that the data is backed up using cloud computing. (2 marks)

Give **one** advantage and **one** disadvantage of the proposal.

Advantage:

_____

_____

Disadvantage:

_____

_____

End of questions

Additional working space

Question number: _____

Additional working space

Question number: _____

Additional working space

Question number: _____

Additional working space

Question number: _____

Additional working space

Question number: _____

ACKNOWLEDGEMENTS

Section One

Question 8 Diagram adapted from: iCarnegie Global Learning. (2009). *2.1.1 Processor basics* (Fig. 2: Fetch–execute cycle). Retrieved May, 2015, from http://trestle.icarnegie.com/content/SSD/SSD2/4.4-Mx/normal/pg-hardware-sys/pg-proc-and-mem/pg-proc-basics/pg-proc-basics.html

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