Computer Science
Stage 3

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

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.
# Structure of this paper

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<th>Section</th>
<th>Number of questions available</th>
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<th>Suggested working time (minutes)</th>
<th>Marks available</th>
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<td>Section One:</td>
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<td>40</td>
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<td>4</td>
<td>110</td>
<td>83</td>
<td>60</td>
</tr>
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<td></td>
<td></td>
<td></td>
<td><strong>100</strong></td>
<td></td>
</tr>
</tbody>
</table>

## 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.
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.

See next page
Question 3

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

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

STUDENT \( \xrightarrow{M} \) \( \xleftarrow{N} \) \( \text{borrows} \) \( \xrightarrow{M} \) \( \text{BOOK} \)

(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  
What is a network (per seat) licence?

Question 6  
What is an enterprise licence?

Question 7  
To record book loans, a high school librarian makes entries in a flat file database as follows:

<table>
<thead>
<tr>
<th>Student name</th>
<th>Form</th>
</tr>
</thead>
<tbody>
<tr>
<td>John Smith</td>
<td>9.01</td>
</tr>
<tr>
<td>Mary Jones</td>
<td>10.02</td>
</tr>
<tr>
<td>John Smith</td>
<td>9.01</td>
</tr>
<tr>
<td>Brian Clark</td>
<td>11.03</td>
</tr>
<tr>
<td>Jane Doe</td>
<td>8.02</td>
</tr>
</tbody>
</table>

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

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

________________________________________________________________________

________________________________________________________________________
Question 12  (5 marks)

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

<table>
<thead>
<tr>
<th>Activity</th>
<th>Start</th>
<th>Finish</th>
</tr>
</thead>
<tbody>
<tr>
<td>Market research</td>
<td>Week 1</td>
<td>Week 4</td>
</tr>
<tr>
<td>Client surveys</td>
<td>Week 3</td>
<td>Week 5</td>
</tr>
<tr>
<td>System design</td>
<td>Week 6</td>
<td>Week 8</td>
</tr>
<tr>
<td>Coding</td>
<td>Week 8</td>
<td>Week 10</td>
</tr>
<tr>
<td>Testing</td>
<td>Week 9</td>
<td>Week 12</td>
</tr>
</tbody>
</table>
Question 13 (3 marks)

In developing programs, there are three types of code:
- source
- byte
- executable.

Match the type to the correct explanations.

<table>
<thead>
<tr>
<th>Type of code</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>code that is used by a specific type of CPU</td>
</tr>
<tr>
<td></td>
<td>code that is used to generate object code</td>
</tr>
<tr>
<td></td>
<td>code that is designed to run virtual machines on different platforms</td>
</tr>
</tbody>
</table>

Question 14 (2 marks)

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

Advantage:
__________________________________________________________________________
__________________________________________________________________________

Disadvantage:
__________________________________________________________________________
__________________________________________________________________________
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

(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)
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.

<table>
<thead>
<tr>
<th>Transmission needed</th>
<th>Transmission medium suggested</th>
<th>Reason for selection</th>
</tr>
</thead>
<tbody>
<tr>
<td>a connection to the file server within 50 metres</td>
<td></td>
<td></td>
</tr>
<tr>
<td>a national company linking to branches within the same State</td>
<td></td>
<td></td>
</tr>
<tr>
<td>a university on a single campus with a combination of desktops and laptops used by staff and students</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Question 17

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:

<table>
<thead>
<tr>
<th>Week</th>
<th>Weekly wage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1 cent</td>
</tr>
<tr>
<td>2</td>
<td>2 cents</td>
</tr>
<tr>
<td>3</td>
<td>4 cents</td>
</tr>
</tbody>
</table>

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

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

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)
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:

<table>
<thead>
<tr>
<th>Description:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

End of Section One
Section Two: Extended answer

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)

```
PATIENT

patient_details

1.0 Create patient account

appointment_details

2.0 Make appointment

Patient

Appointment
```
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).
(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.

<table>
<thead>
<tr>
<th>Type of data integrity</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ensures that there are no duplicate records in a table</td>
</tr>
<tr>
<td></td>
<td>ensures that a value in a foreign key exists in its corresponding primary key table</td>
</tr>
<tr>
<td></td>
<td>ensures that a value in an attribute lies within a range of given values</td>
</tr>
</tbody>
</table>
**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)

<table>
<thead>
<tr>
<th>Element name</th>
<th>Data type</th>
<th>Size/Format</th>
<th>Description</th>
<th>Constraint</th>
</tr>
</thead>
<tbody>
<tr>
<td>PatientID</td>
<td>Number</td>
<td>6</td>
<td></td>
<td>Required. Automatically created when record added</td>
</tr>
<tr>
<td>GivenName</td>
<td>String</td>
<td>25</td>
<td>Given name of patient (e.g. Barry)</td>
<td>Required</td>
</tr>
<tr>
<td>FamilyName</td>
<td>String</td>
<td>25</td>
<td>Surname of patient (e.g. Boan)</td>
<td>Required</td>
</tr>
<tr>
<td>Address</td>
<td>String</td>
<td>30</td>
<td>The street address of patient</td>
<td>Required</td>
</tr>
<tr>
<td>Suburb</td>
<td>String</td>
<td>30</td>
<td>The suburb where the patient lives</td>
<td>Required</td>
</tr>
<tr>
<td>Postcode</td>
<td>String</td>
<td></td>
<td>Postcode of patient</td>
<td></td>
</tr>
<tr>
<td>Telephone</td>
<td>String</td>
<td>10</td>
<td>Telephone number of patient</td>
<td>Required</td>
</tr>
<tr>
<td>Email</td>
<td>String</td>
<td>30</td>
<td>Email address</td>
<td>Required, as email confirmation is given for appointment</td>
</tr>
<tr>
<td>Gender</td>
<td>String</td>
<td>6</td>
<td>Gender of patient</td>
<td>Required, Male or Female are the only choices</td>
</tr>
<tr>
<td>DOB_Year</td>
<td>N/A</td>
<td></td>
<td>Year of birth</td>
<td>Required</td>
</tr>
<tr>
<td>DOB_DM</td>
<td>5</td>
<td></td>
<td>Date of Birth Day and Month (e.g. 30/07)</td>
<td></td>
</tr>
</tbody>
</table>
(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.
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. $2 \times 10 = 20$ 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
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)

<table>
<thead>
<tr>
<th>Line#</th>
<th>Hundreds</th>
<th>Tens</th>
<th>Ones</th>
<th>Sum</th>
<th>CheckDigit</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td></td>
<td></td>
<td></td>
<td>5</td>
<td>5</td>
</tr>
</tbody>
</table>

Circle the answer:
The check digit has been calculated correctly.
(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:

\[ S\text{Value} = 120, 140, 134, 0. \]
\[ D\text{Value} = 80, 75, 82, 0. \]

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.
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)
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.

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

Draw your diagram below the line.
(d) Each medical practice would need to take precautions against phishing. List two strategies that could be used.  

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?  


(ii) Name one ethical issue in data mining.  


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: _______________
ACKNOWLEDGEMENTS

Section One

Question 8


CONSULTANT CHECK
INITIALS DATE

CSC 3 EXAM