On the basis of your performance in this examination, the examiners will provide results on the following criterion taken from the course statement:

**Criterion 1**  Design and evaluate algorithmic solutions to a range of problems.
CANDIDATE INSTRUCTIONS

Candidates **MUST** ensure that they have addressed the externally assessed criterion on this examination paper.

Answer **ALL** questions. Answers must be written in the spaces provided on the examination paper.

You should make sure you answer all parts within each question so that the criterion can be assessed.

This examination is 3 hours in length. It is recommended that you spend approximately 35 minutes in total answering the questions in this booklet.

**All written responses must be in English.**

To be considered for a ‘C’ rating on a criterion, you must provide a satisfactory answer to at least the first question of the relevant section.

To be considered for a ‘B’ rating on a criterion, you must provide a satisfactory answer to at least the first two questions of the relevant section.

To be considered for an ‘A’ rating on a criterion, you must provide a satisfactory answer to all three questions of the relevant section.

You should show the methods used in deriving answers.

You should take care with the presentation of your answers, which should be complete and to the point. Diagrams should be used where appropriate. Complete sentences should be used in questions involving explanations. You are reminded that poor handwriting, spelling and expression that make it difficult for the examiners to understand what you mean may lead to lower marks.
Question 1

The following is a *partially completed* algorithm for an applet designed to calculate the average speed of a bike ride given the distance and the time (in hours and minutes).

The numbers on the left of the algorithm are provided for reference purposes.

```plaintext
1 Initially
2   distance = 0
3   hour = 0
4   minute = 0

5 When a number is entered into “distance” TextField
6     Set distance to value in “distance” TextField
7     if distance < 0
8         distance = 0
9     Display “Distance travelled: ” distance

10 When a number is entered into “hour” TextField
11     Set hour to value in “hour” TextField
12     Display “Number of hours: ” hour

13 When a number is entered into “minute” TextField
14     Set minute to value in “minute” TextField
15     if minute < 0
16         minute = 0
17     Display “Number of minutes: ” minute

18 When the “Calculate” button is pressed
19     time = hour + minute / 60
20     speed = distance / time
21     Display “Average speed: ” speed
```

The following intended features of the program do not work. Indicate the necessary changes to the algorithm so that these features work.

(a) The number of hours that can be entered should be greater than or equal to zero. If a number less than zero is entered *hour* should be set to zero.

```
10 When a number is entered into “hour” TextField
11     Set hour to value in “hour” TextField

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Question 1 continues opposite.
```
Question 1 (continued)

(b) The number of minutes should be between 0 and 59. If a number outside this range is entered minute should be set to 0.

13 *When a number is entered into “minute” TextField*
14    Set minute to value in “minute” TextField
15    if minute < 0
16    minute = 0

(c) The calculation of the speed will produce an error if the value of time is zero. If the value of time is zero speed should be set to zero.

18 *When the “Calculate” button is pressed*
Question 2

The following is a partially completed algorithm for an applet to be used to calculate the score for a player in a dart throwing game. The user enters the result of a dart thrown at a board made up of nine zones as shown below.

The result is the number in the particular zone (from 1 to 9). The result is doubled by the algorithm if the dart is in the shaded region of the zone. For example the result of 7 will be doubled to 14 for a dart at position X on the board above.

For example: The player’s score starts at 101 and the result of each throw is subtracted from the score. If the throw above was the first throw, then the score would become 101 – 14 = 87. The player wins when the score is zero.

The user will enter into the applet the dart result and whether it was a double. The applet will then calculate the score after each throw.

The numbers on the left of the algorithm are provided for reference purposes.

```
1 Initially
2   result = 0
3   double = "NO"
4   score = 101

5 When a number is entered into “dart” TextField
6   Set result to value in “dart” TextField
7   Display “Dart result is: ” result

8 When text is entered into “double” TextField
9   Set double to text in “double” TextField
10  if double not equal to "YES" and double not equal to "NO"
11     set double to "NO"
12  Display “Double value is: ” double

13 When the “Calculate” button is pressed
14   if double equals “YES"
15     score = score – result * 2
16   else
17     score = score – result
18   Display “Score is: ” score
19   if score = 0
20     Display “player wins”
```

Question 2 continues opposite.
Question 2 (continued)

(a) The value entered for the result needs to be checked to see that it is valid. If it is not valid then it should be set to zero. Add this feature to the algorithm.

5 *When a number is entered into “dart” TextField*

6 Set result to value in “dart” TextField

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(b) The player must end the game by scoring exactly zero. This means that the last dart must have a result that will be subtracted from the score to give exactly zero.

If the player’s score is 7 and the next result is 7, then $7 - 7 = 0$ and the game ends.

If the player’s score is 7 and the next result is 8 then $7 - 8 = -1$ and the score will stay as 7 and the player must throw again.

Add this feature to the algorithm.

13 *When the “Calculate” button is pressed*

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Question 3

An applet is needed for calculating the maximum distance a viewer can sit from a television set and still see all the detail on the screen.

The algorithm needs to know the size of the television set. This can be given as the width or the diagonal of the screen.

In addition the algorithm needs to know whether the television is PAL or HDTV and whether the screen is WIDESCREEN or STANDARD. The calculation is then done as follows:

First, if the size is given as a diagonal this will need to be converted to a width measurement.

For a WIDESCREEN this is done using

\[ width = diagonal \times 0.8716. \]

For a STANDARD screen it is done using

\[ width = diagonal \times 0.8000. \]

The maximum viewing distance is then calculated.

For a PAL television this is done using

\[ distance = width \times 4.789. \]

For an HDTV television it is done using

\[ distance = width \times 1.796. \]

Note: Assume that width and diagonal are entered as numbers.
Question 3 (continued)

(a) Using the Initially/When model, write an algorithm for this applet that calculates and displays maximum viewing distance as described.
(b) Draw the applet window for your applet, identifying all the text fields and/or buttons used.
This question paper and any materials associated with this examination (including answer booklets, cover sheets, rough note paper, or information sheets) remain the property of the Tasmanian Qualifications Authority.
On the basis of your performance in this examination, the examiners will provide results on the following criterion taken from the course statement:

**Criterion 2**  Demonstrate knowledge of a high level programming language.
CANDIDATE INSTRUCTIONS

Candidates **MUST** ensure that they have addressed the externally assessed criterion on this examination paper.

Answer **ALL** questions. Answers must be written in the spaces provided on the examination paper.

You should make sure you answer all parts within each question so that the criterion can be assessed.

This examination is 3 hours in length. It is recommended that you spend approximately 35 minutes in total answering the questions in this booklet.

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You should take care with the presentation of your answers, which should be complete and to the point. Diagrams should be used where appropriate. Complete sentences should be used in questions involving explanations. You are reminded that poor handwriting, spelling and expression that make it difficult for the examiners to understand what you mean may lead to lower marks.
Question 4

(a) What will be the values of $a$, $b$ and $c$ after the following code is executed?

```java
double a, b, c;
a = 3;
b = 17 - 5 * a;
c = Math.pow(a, 2);
```

Value of $a$: ........................................................................................................................

Value of $b$: ........................................................................................................................

Value of $c$: ........................................................................................................................

(b) What will be the value of $t$ after the following code is executed?

```java
int r = 7;
int t;
if (r > 10)
{
    t = 1;
}
else
{
    if (r > 5)
    {
        t = 2;
    }
    else
    {
        t = 3;
    }
}
```

Value of $t$: ........................................................................................................................

Explanation:

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Question 4 continues opposite.
Question 4 (continued)

(c) Trace the following code and find the final value of the variable n.

```java
int n = 1;
while (n < 10)
{
    n = n * 2;
}
```

Trace:

<table>
<thead>
<tr>
<th>n</th>
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<tbody>
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</table>

Final value of n: ..........................................................
Question 5

(a) What will be the value of \( q \) after the following code is executed?

```java
int p = 2;
int q = 5;
switch (p)
{
    case 1: q = 4;
    case 2: q = q + 1;
    case 3: q = q + 3;
}
```

Final value of \( q \): ................................................................................................................

Explanation:
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(b) What will be the value of \( j \) and value of \( k \) after the following code is executed?

```java
int j = 14/4*10;
int k = (int)(14/(double)4*10);
```

Value of \( j \): .........................................................................................................................

Value of \( k \): ........................................................................................................................

Explanation:
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Question 5 continues opposite.
Question 5 (continued)

(c) The method sum is defined as follows:

```java
public double sum(double[] v)
{
    double sumv = 0;
    for(int i = 0; i < 4; i++)
    {
        sumv = sumv + v[i];
    }
    return sumv;
}
```

Use the trace table to find the value of $m$ after the following code is executed.

double[] v = new double[] {2, 1, 3, 14};
double m = sum(v)/4;

Trace table:

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</tbody>
</table>

Final value of $m$: ..............................................................................................................................................
Question 6

This question relates to the program on the next page. The numbers on the left are not part of the program and are provided for reference purposes.

(a) Below is an alternative definition of the method `sum` from the one in the program on lines 13 – 21. It is used to sum all the values in the array `a`.

```java
public void sum(double[] a, double suma)
{
    suma = 0;
    for(int i = 0; i < 7; i++)
        suma = suma + a[i];
}
```

To use this definition of the method `sum` lines 39 and 40 need to be changed to match as below:

```java
sum(x,sumx);
sum(y,sumy);
```

Explain why this alternative definition of method `sum` would not work.

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(b) If the following changes were made to the number of values in the arrays, the program will not give the correct result.

```java
x = new double[] {2, 5, 12, 17, 34, 18, 56, 123, 241};
y = new double[] {11, 18, 34, 44, 105, 47, 135, 245, 452};
```

(i) Explain why the program will not work when the array size is changed.

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(ii) Indicate the modification you need to make to the program so that it always works for all array sizes.

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Question 6 continues opposite.
import java.awt.*
import java.applet.Applet;
import java.awt.event.*;

public class Question6 extends Applet{
    double[] x, y;
    double meanx, meany, sumx, sumy, diffxy, diffxs, diffys, r;

    public void init(){
        x = new double[]{2, 5, 12, 17, 34, 18, 56};
        y = new double[]{11, 18, 34, 44, 105, 47, 135};
    }

    public double sum(double[] a){
        double suma = 0;
        for(int i = 0; i < 7; i++){
            suma = suma + a[i];
        }
        return suma;
    }

    public void displayResult(double r, Graphics g){
        g.drawString("Correlation Coefficient r = "+r,100,100);
        r = Math.abs(r);
        if (r > 0.75)
            g.drawString("and so this is a strong relationship.", 100,120);
        else
            if (r > 0.5)
                g.drawString("and so this is a moderate relationship.", 100,120);
            else
                if (r > 0.25)
                    g.drawString("and so this is a weak relationship.", 100,120);
                else
                    g.drawString("and so there is no relationship.", 100,120);
    }

    public void paint(Graphics g){
        sumx = sum(x);
        sumy = sum(y);
        meanx = sumx/x.length;
        meany = sumy/x.length;
        diffxy = 0;
        diffxs = 0;
        diffys = 0;
        for (int i = 0; i < x.length; i++){
            diffxy = diffxy + (x[i]-meanx)*(y[i]-meany);
            diffxs = diffxs + Math.pow(x[i]-meanx,2);
            diffys = diffys + Math.pow(y[i]-meany,2);
        }
        r = diffxy/(Math.sqrt(diffxs)*Math.sqrt(diffys));
        displayResult(r, g);
    }
}

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Tasmanian Certificate of Education

COMPUTER SCIENCE

Senior Secondary

Subject Code: ITC315108

External Assessment

2012

Section C – Criterion 3

Time: approximately 35 minutes

On the basis of your performance in this examination, the examiners will provide results on the following criterion taken from the course statement:

Criterion 3   Use appropriate objects in the design of programs.
CANDIDATE INSTRUCTIONS

Candidates **MUST** ensure that they have addressed the externally assessed criterion on this examination paper.

Answer **ALL** questions. Answers must be written in the spaces provided on the examination paper.

You should make sure you answer all parts within each question so that the criterion can be assessed.

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You should take care with the presentation of your answers, which should be complete and to the point. Diagrams should be used where appropriate. Complete sentences should be used in questions involving explanations. You are reminded that poor handwriting, spelling and expression that make it difficult for the examiners to understand what you mean may lead to lower marks.
Question 7

The following diagram shows an applet window with two buttons and a text field (box1Button, box2Button and winField). The ActionListener has been added to box1Button and box2Button.

![Diagram of applet window with two buttons and a text field]

The initial values of the char variables box1 and box2 are ‘X’.
The initial value of the char variable player is ‘A’.
The text field winField initially contains “none”.

The actionPerfomed method for the applet is as follows:

```java
public void actionPerformed(ActionEvent e) {
    if (e.getSource() == box1Button) {
        if (box1 == 'X')
            box1 = player;
    }
    if (e.getSource() == box2Button) {
        if (box2 == 'X')
            box2 = player;
    }
    if (player == 'A')
        player = 'B';
    else
        player = 'A';
    if (box1 == box2)
        winField.setText("" + 'A');
}
```

What will be the values of the variables box1, box2 and player and what will be displayed in the text field winField after each of the following actions is executed in sequence?

(a) The user clicks on Box1Button.

box1: ........................................................................................................................................
box2: ........................................................................................................................................
player: ........................................................................................................................................
winField: ......................................................................................................................................
Question 7 (continued)

(b) The user clicks on Box1Button.

box1: ................................................................................................................................
box2: ................................................................................................................................
player: ................................................................................................................................
winField: ...........................................................................................................................

(c) The user clicks on Box2Button.

box1: ................................................................................................................................
box2: ................................................................................................................................
player: ................................................................................................................................
winField: ...........................................................................................................................
Question 8

(a) Show the value of the variable `string3` each time it changes during the following section of code.

```java
String string1 = "The ice cold ice-cream";
String string2 = "phone";
String string3 = "";
int p = string1.indexOf("ice", 8);
string3 = string1.substring(0, p + 1);
string3 = string3 + string2.toUpperCase();
```

First value of `string3`:

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Second value of `string3`:

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Third value of `string3`:

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(b) The following is a description of the Point object:

<table>
<thead>
<tr>
<th>Field Summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>int <code>x</code></td>
</tr>
<tr>
<td>int <code>y</code></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Constructor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Point()</td>
</tr>
<tr>
<td>Constructs a Point with coordinates (0, 0). i.e. <code>x = 0</code> and <code>y = 0</code></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Methods</th>
</tr>
</thead>
<tbody>
<tr>
<td>void <code>move(int x, int y)</code></td>
</tr>
<tr>
<td>Sets the coordinates of the Point to the specified x and y.</td>
</tr>
<tr>
<td>void <code>translate(int x, int y)</code></td>
</tr>
<tr>
<td>Moves the Point the indicated distances, to the right along the x coordinate axis and downward along the y coordinate axis.</td>
</tr>
<tr>
<td>double <code>distance(Point p)</code></td>
</tr>
<tr>
<td>Returns the distance between the Point and the specified Point.</td>
</tr>
<tr>
<td>Point <code>setLocation(Point p)</code></td>
</tr>
<tr>
<td>Sets the coordinates of the Point to the coordinates of the specified Point.</td>
</tr>
</tbody>
</table>

Question 8 continues opposite.
The following code uses the Point object. Draw the applet window after the code has been executed.

```java
Point point1 = new Point();
Point point2 = new Point();
Point point3 = new Point();
Point point4 = new Point();

point1.move(200,10);
point2.setLocation(point1);
point2.translate(0,400);

int d = (int)point1.distance(point2);

point3.move(0, d/2);
point4.setLocation(point3);
point4.translate(d,0);

g.drawString("(\(\text{point1.x}, \text{point1.y}\))",point1.x,point1.y);
g.drawString("(\(\text{point2.x}, \text{point2.y}\))",point2.x,point2.y);
g.drawString("(\(\text{point3.x}, \text{point3.y}\))",point3.x,point3.y);
g.drawString("(\(\text{point4.x}, \text{point4.y}\))",point4.x,point4.y);
```

View of applet window:
Question 9

The class definition below defines a collection of coins.

(a) Using the class definition, write code to declare and instantiate a variable of the object type defined by the class.

(b) Using the method enter() and the variable from part (a), add a coin to the collection with the following properties: country = Australia, collector value = 700, year = 1958, face value = 500.

(c) Using a for loop and the getNumber() and getCollect() methods, sum the collector values of all the coins in the collection.

```java
public class Coins {
    private double[] faceVal = new double[100];
    private double[] collectVal = new double[100];
    private String[] country = new String[100];
    private String[] year = new String[100];
    private int number;

    public Coins() {
        number = 0;
    }

    public void enter(double faceEnter, double collectEnter, String countryEnter, String yearEnter) {
        number = number + 1;
        faceVal[number] = faceEnter;
        collectVal[number] = collectEnter;
        country[number] = countryEnter;
        year[number] = yearEnter;
    }

    public double getFace(int index) {
        return faceVal[index];
    }

    public double getCollect(int index) {
        return collectVal[index];
    }

    public String getCountry(int index) {
        return country[index];
    }

    public String getYear(int index) {
        return year[index];
    }

    public int getNumber() {
        return number;
    }
}
```

Question 9 continues opposite.
Spare Answer Sheet if Required

Question Number: 

(In the box write the number of the question you have answered.)

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External Assessment

2012

Section D – Criterion 4

Time: approximately 35 minutes

On the basis of your performance in this examination, the examiners will provide results on the following criterion taken from the course statement:

Criterion 4  Demonstrate knowledge and understanding of computer architecture.
CANDIDATE INSTRUCTIONS

Candidates MUST ensure that they have addressed the externally assessed criterion on this examination paper.

Answer ALL questions. Answers must be written in the spaces provided on the examination paper.

You should make sure you answer all parts within each question so that the criterion can be assessed.

This examination is 3 hours in length. It is recommended that you spend approximately 35 minutes in total answering the questions in this booklet.

All written responses must be in English.

To be considered for a ‘C’ rating on a criterion, you must provide a satisfactory answer to at least the first question of the relevant section.

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Question 10

(a)  (i) Fill in the four missing bits in the following binary addition.

\[
\begin{array}{c}
1 \square 1 0 1 \\
+ 1 1 \square 0 \\
\hline
1 \square 1 \square 1 1
\end{array}
\]

(ii) A computer uses an 8 bit word with a two's complement representation for integers.

Using \(9 - 5 = 4\) as an example, explain how subtraction is done with two's complement addition in this computer.

(b) The following 16 bit word is used to hold a character stored as ASCII code.

\[000000001100001\]

What is the character?

(c) What is the minimum storage required to store the value of a boolean variable?

For Marker Use Only
Question 11

(a) (i) Give the logic expression for D from the logic circuit below:

(ii) Use logic laws to show that the expression from (i) can be simplified to

\[ D = \text{not}(A \text{ or } B) \text{ and } C \]
Question 11 (continued)

(b) The following table contains a TOY machine code segment that implements a **while statement**.

Write the java code, including the **while statement** structure and the variable \( a \), that is the equivalent of this machine code.

<table>
<thead>
<tr>
<th>Memory Address</th>
<th>Contents</th>
<th>Pseudocode</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>00</td>
<td>0000</td>
<td>data</td>
<td>The variable ( a )</td>
</tr>
<tr>
<td>01</td>
<td>0010</td>
<td>data</td>
<td>The constant 16</td>
</tr>
<tr>
<td>02</td>
<td>0002</td>
<td>data</td>
<td>The constant 2</td>
</tr>
<tr>
<td>03</td>
<td>0003</td>
<td>data</td>
<td>The constant 3</td>
</tr>
<tr>
<td>10</td>
<td>8303</td>
<td>R[3] ← mem[03]</td>
<td>Set Register 3 to the contents of location 03</td>
</tr>
<tr>
<td>11</td>
<td>8202</td>
<td>R[2] ← mem[02]</td>
<td>Set Register 2 to the contents of location 02</td>
</tr>
<tr>
<td>12</td>
<td>9200</td>
<td>mem[00] ← R[2]</td>
<td>Store Register 2 in location 00</td>
</tr>
<tr>
<td>13</td>
<td>8A00</td>
<td>R[A] ← mem[00]</td>
<td>Set Register A to the contents of location 00</td>
</tr>
<tr>
<td>14</td>
<td>8B01</td>
<td>R[B] ← mem[01]</td>
<td>Set Register B to the contents of location 01</td>
</tr>
<tr>
<td>16</td>
<td>DC1A</td>
<td>if (R[C] &gt; 0) pc ← 1A</td>
<td>Branch to address 1A if Register C &gt; 0</td>
</tr>
<tr>
<td>18</td>
<td>9A00</td>
<td>mem[00] ← R[A]</td>
<td>Store Register A in location 00</td>
</tr>
<tr>
<td>19</td>
<td>C013</td>
<td>if (R[0] == 0) pc ← 13</td>
<td>Branch to address 13 if Register 0 = 0</td>
</tr>
<tr>
<td>1A</td>
<td>0000</td>
<td>halt</td>
<td>End of program</td>
</tr>
</tbody>
</table>
Question 12

Answer EITHER Part (a) OR Part (b) of this question, but NOT both.

(a) You are developing a new sound file format call “FREQ”. Your sound file will need to have a header which allows your software to know the properties of the sound data.

The header must contain the following information needed by your FREQ software:

- Text to identify the file as a FREQ file: “FREQ”
- The sample size (in bits): 8, 16, 20, 24 or 32
- The samples per second: 8 000, 16 000, 24 000, 32 000, 44 100, 48 000, 96 000 or 192 000
- Number of channels: 1(mono) or 2(stereo)

You want your header to be as small as possible to keep the size of your FREQ file as small as possible.

(i) Determine the number of bits required to store all the information in the header. Explain your calculation of the number of bits.

(ii) Show the bit pattern for the header that would represent a typical CD-based sound file with specifications: stereo with 44 100 samples per second and 16 bits per sample.

Question 12 continues over the page.
(b) The Central Processing Unit (CPU) carries out instructions such as:

\[
8A03 \text{ Load } R[A] \leftarrow \text{mem}[03]
\]

The process for this particular instruction can be described in the following three steps:

1. The **control unit** sends the number 03 to the Memory Address Register.
2. The contents of location 03 in the **memory** is transferred via a **bus** to the Memory Buffer Register (MBR).
3. The contents of the MBR is transferred to the **Register** A in the CPU.

(i) Explain the following four terms:

- **Control unit:**  
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- **Memory:**  
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- **Bus:**  
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- **Register:**  
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**Question 12 continues opposite.**
Question 12 (continued)

(ii) Using the description above as a guide, give the three-step description of the process for the instruction:

\[ 9C05 \text{ Store mem[05]} \leftarrow R[C] \]
Spare Answer Sheet if Required

Question Number: 

(In the box write the number of the question you have answered.)
This question paper and any materials associated with this examination (including answer booklets, cover sheets, rough note paper, or information sheets) remain the property of the Tasmanian Qualifications Authority.
On the basis of your performance in this examination, the examiners will provide results on the following criterion taken from the course statement:

**Criterion 5**  Design and evaluate networking solutions to small scale networks.
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Question 13

(a) What are the features of an ADSL modem?

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(b) Explain why the use of a switch to connect computers via cables produces a LAN with a star topology.

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(c) What information is added to the data when a packet is created?

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Question 14

(a) Compare a peer-to-peer network and a client-server network.

(b) Describe the factors that need to be considered when positioning a wireless access point in a home.
The home network in the house above consists of an ADSL 2+ modem router situated in the study with a desktop computer connected to it by an ethernet patch lead. The desktop computer has a laser printer attached to it by USB. This machine is used primarily by the father for his work purposes. He requires a reliable high speed internet connection to do his work. The three children all have laptops which they use for both school work and entertainment, particularly online games. There is a printer located in the family room for anyone to print to; connected to the network by a wireless print server.

(a) Discuss the placement of equipment and types of connections and provide justification for the current set up OR suggest modifications with justification.

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Question 15 continues opposite.
Question 15 (continued)

(b) The mother has just set up a furniture design and manufacturing company, which she will run from home in the newly built studio and workshop. She has just purchased a desktop computer with dual widescreen monitors on which to do her design work and keep the business accounts. She also has a high quality A3 colour inkjet printer. She uses the internet for design inspiration and communicating with clients. Given she would like this equipment to be located in her Studio, describe the best way for this equipment to be connected to the current network in the home. Make sure to justify any solution you describe.
Spare Answer Sheet if Required

Question Number: 

(In the box write the number of the question you have answered.)

For Marker Use Only
Spare Answer Sheet if Required

Question Number: __________

(In the box write the number of the question you have answered.)