

Exam Questions

6.3 Thinking Procedurally

Components of a Problem in Computational Thinking / Order of Steps in Problem Solving / Sub-Procedures

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Total Marks

/18

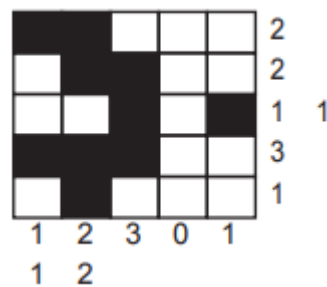
- 1 A program is being designed that will allow a user to log into an account on a website using a username and password.

Identify two possible sub-procedures that could be used in this program.

(2 marks)

- 2 A Nonogram is a logic puzzle where a player needs to colour in boxes. The puzzle is laid out as a grid and each square needs to be either coloured black or left white.

The numbers at the side of each row and column tells the player how many of the boxes are coloured in consecutively. Where a row has two or more numbers, there must be a white square between the coloured squares.



In this example:

- the first column has 1 1, this means there must be two single coloured boxes in this column. There must be at least 1 white box between them.
- the first row has 2, this means there must be two consecutively coloured boxes in the row.

Juan is creating a program that will store a series of Nonograms for a user to play. The game will randomly select a puzzle and display the blank grid with the numbers for each row and column to the user.

The user plays the game by selecting a box to change its colour. If the box is white it will change to black and if it is black it will change to white. The user can choose to check the answer at any point, and the game will compare the grid to the answers and tell the user if they have got it correct or not.

Juan wants to create a program that will generate new Nonograms with different grid sizes. For example a Nonogram with a 10×10 grid or a 5×20 grid.

Describe how the program could be written to automatically generate a new Nonogram.

(4 marks)

3 A program written using the Little Man Computer instruction set is shown in **Fig. 1**.

```

                                INP
                                STA numone
                                INP
                                STA numtwo
main      LDA numone
          SUB numtwo
          BRP pos
notpos    LDA count
          OUT
          LDA numone
          OUT
          HLT
pos       STA numone
          LDA count
          ADD one
          STA count
          BRA main
numone    DAT
numtwo    DAT
one       DAT 1
count     DAT 0
```

Write an algorithm using pseudocode that has the same functionality as the code in **Fig. 1**

(4 marks)

4 Two people play a counting game. The rules of the game are as follows:

- The first player starts at 1
- Each player may choose one, two or three numbers on their turn and the numbers must be in ascending order
- Players take it in turns to choose
- The player who chooses "15" loses the game.

For example, if the first player chooses three numbers (1, 2, 3) then the second player could choose one number (4), two numbers (4, 5) or three numbers (4, 5, 6). The first player then takes another go.

Write an algorithm using pseudocode that allows two players to play this game. The algorithm should:

- Alternate between player 1 and player 2
 - Ask the player how many numbers they would like to choose, ensuring that this is between 1 and 3
 - Display the numbers that the player has chosen
 - Display a suitable message to say which player has won once the number 15 has been displayed.
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(8 marks)