DEVELOPMENT METHODOLOGIES

Describe and implement the phases of an iterative process: analysis, design, implementation, testing, documentation, and evaluation within general programming problem solving

SQP Q2

2. Explain why it may be necessary to return to the implementation stage of an iterative development process after the testing stage. **1**

ANALYSIS

Identify the purpose and functional requirements of a problem that relates to the design and implementation at this level, in terms of:

- *Inputs*
- *Processes*
- *Outputs*

SQP Q16a

16. Pam is creating an application that will find and display a person's tax rate based on their salary.

Salary	Tax rate
0–12000	0
12001–40000	20
40001 upwards	40

(a) Analyse the problem and identify the input, the process and the output. **3**

Input _____

Process _____

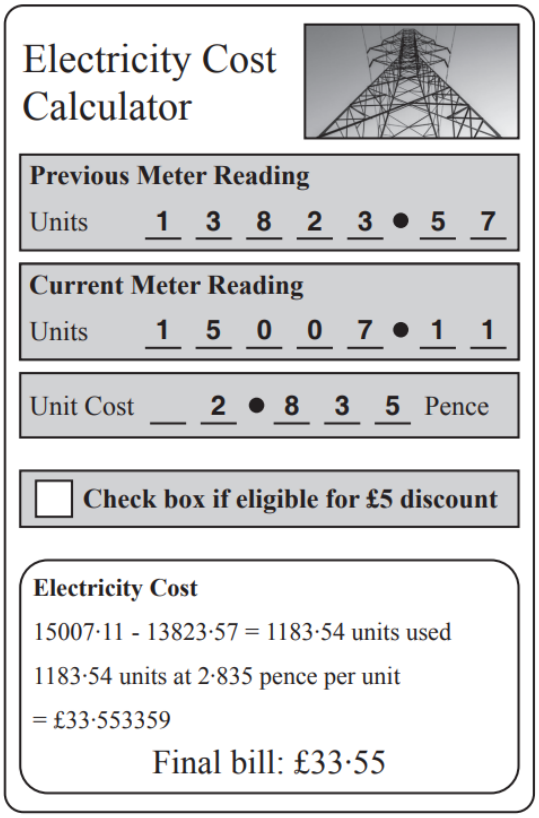
Output: _____

2019 Q13a

13. A smart phone app is needed to calculate the cost of electricity. The following information will be entered by the user.

- Previous meter reading
- Current meter reading
- Unit cost
- Discount eligibility

A possible user interface for the app is shown below.



(a) Describe two processes that will be carried out by the program. **2**

1. _____

2. _____

2018 Q19a

19. A program is being designed that will allow pupils to add money to their lunch money account. The user enters their name, an 8 character password and the amount of money they want to add. A button is then clicked and the updated balance of the account is displayed.

(a) Analyse the problem and identify all inputs, processes and outputs. **3**

Input _____

Process _____

Output _____

DESIGN

Identify the data types and structures required for a problem that relates to the implementation at this level as listed below:

Describe, identify, and be able to read and understand:

- *Structure diagrams*
- *Flowcharts*
- *Pseudocode*

SQP Q19a, Q19b

19. Read the following design for a solution to a problem.

Algorithm

1 Ask the user to enter their name

2 Ask the user to enter their flight details

3 Generate the holiday booking reference

4 Display the holiday booking reference

Refinements

1.1 Ask user to enter surname only

2.1 Ask user to enter first three letters of departure airport (for example: Edi for Edinburgh)

2.2 Ask user to enter first three letters of arrival airport

3.1 Store the booking reference as: arrival airport string + surname + departure airport string

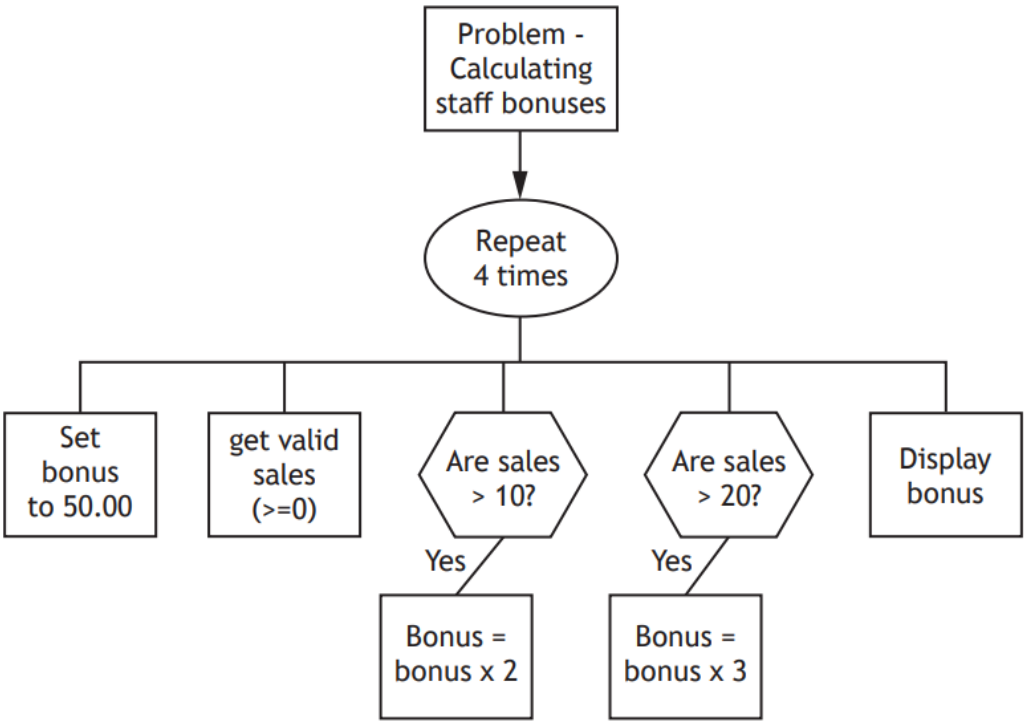
(a) State which design technique has been used for the above solution. **1**

(b) State the output expected if the design is tested by Kate Bryant who is flying from Glasgow to Barcelona. **3**

SQP Q21c(ii) – c(i) is included for reference

21. Arthur's Antiques sells old furniture. All staff receive a monthly bonus of £50, which is increased if they sell over 10 items of furniture. The bonus is increased further if they sell over 20 items of furniture.

A design for the program used to calculate the bonus payment for each of the four members of staff is shown below.



(c) The program is further tested with normal test data. The results are shown below.

	Sales input	Expected output	Actual output
Staff 1	6	Bonus is 50	Bonus is 50
Staff 2	10	Bonus is 50	Bonus is 50
Staff 3	15	Bonus is 100	Bonus is 100
Staff 4	22	Bonus is 150	**Bonus is 300**

(i) State the type of error. **1**

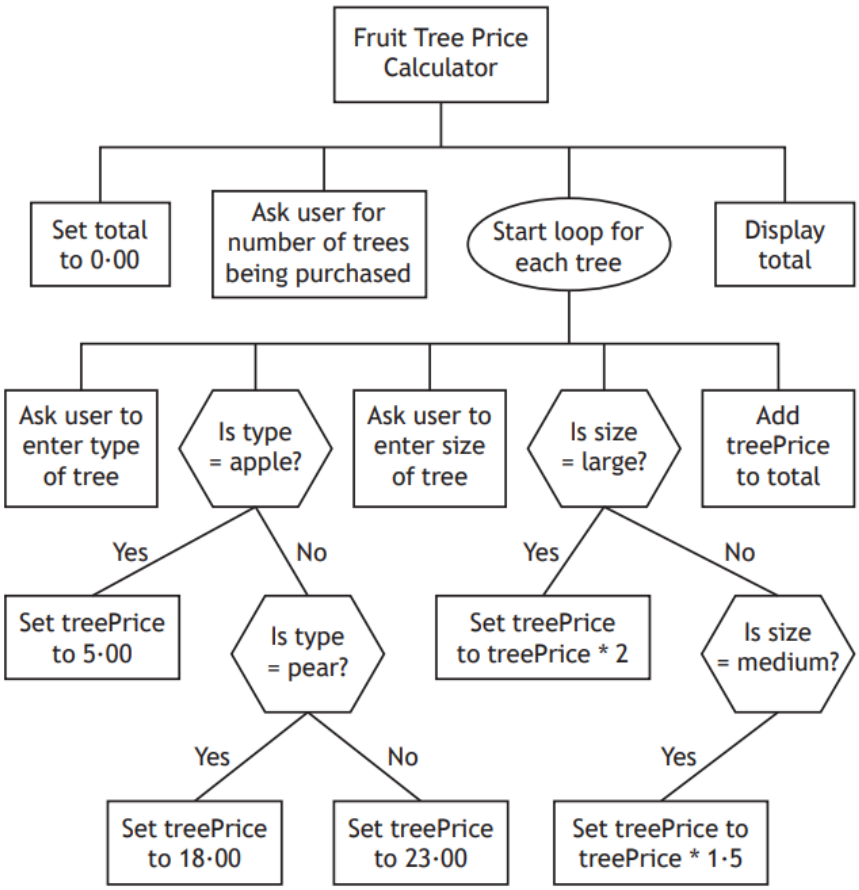
_____

(ii) Describe how this design error could be corrected. You may wish to write a description or re-draw part of the design. **2**

2019 Q5

5. A garden centre requires a program to calculate the price of apple, pear and cherry trees being sold.

The design is shown below.



(a) State the type of loop shown in the design above. **1**

_____

(b) The design is tested. For the following inputs state the total displayed. **1**

Inputs	**Total displayed**
Number of trees – 2 Type of tree – cherry Size of tree – small Type of tree – pear Size of tree – medium	

(c) The garden centre is considering selling orange trees for £23·00.

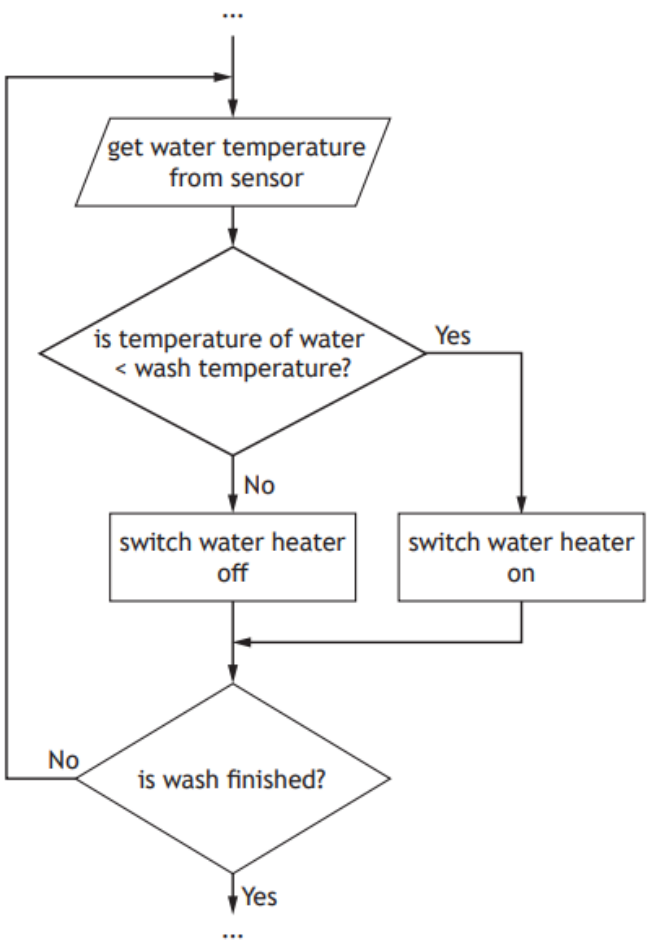
Explain why the design does not need to be changed. **1**

2019 Q16a, Q16b

16. A program to control the water temperature inside a washing machine is being designed. The user will select a wash temperature using the control panel on the machine.

The program should ensure that the water stays heated at the correct temperature throughout the wash.

The design for the part of the program that maintains the water temperature is shown below.



(a) State the design technique that has been used to design the solution. **1**

(b) To implement the program several programming constructs will be required.

(i) State the condition used in the loop construct. **1**

_____

(ii) State one other construct that has been used in the design and describe how that construct has been used. **2**

Construct _____

Description _____

2018 19a

19. A program is being designed that will allow pupils to add money to their lunch money account. The user enters their name, an 8 character password and the amount of money they want to add. A button is then clicked and the updated balance of the account is displayed.

(a) Analyse the problem and identify all inputs, processes and outputs. **3**

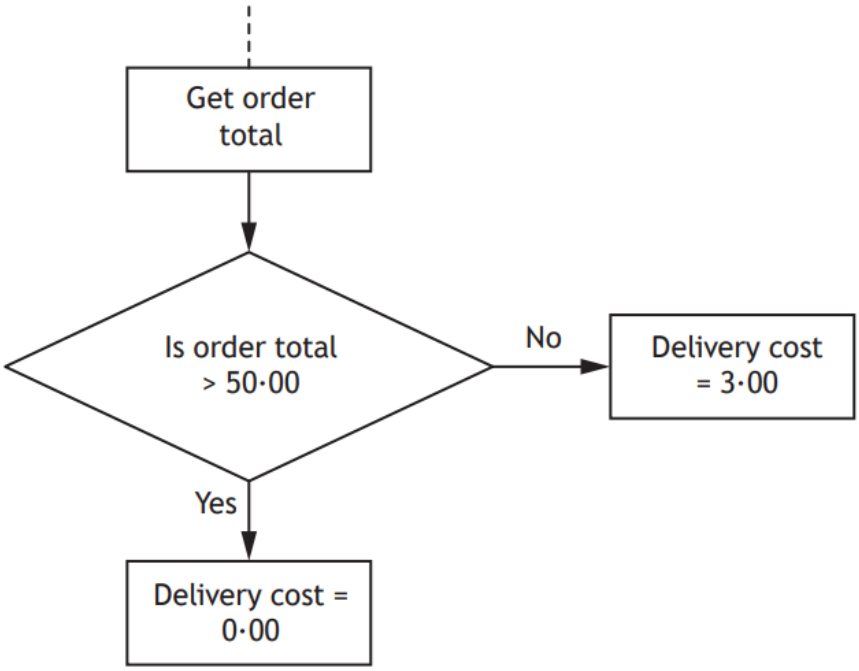
Input _____

Process _____

Output _____

2017 Q13

13. Part of the design of a program is shown below.



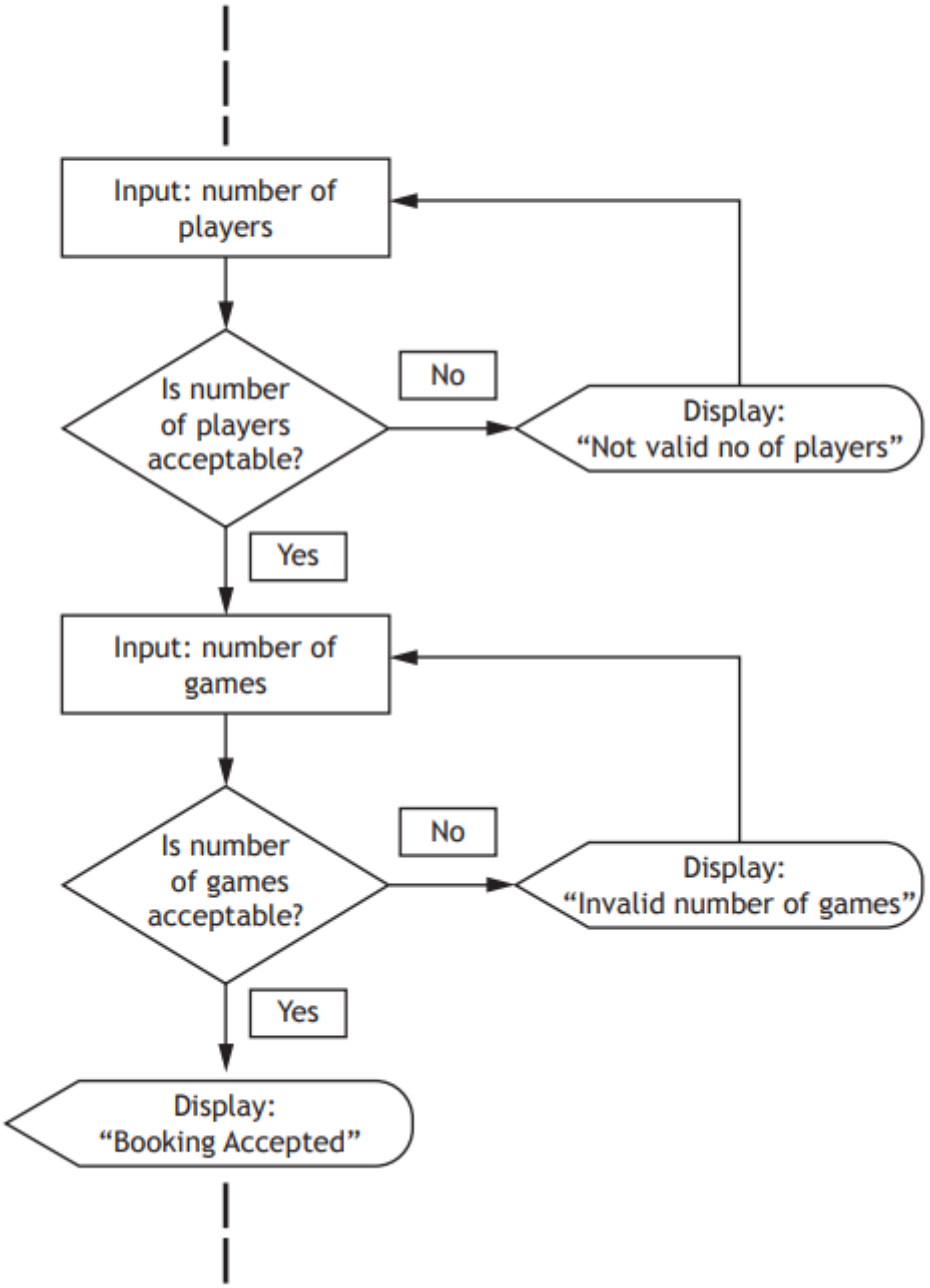
Identify the graphical design notation shown above. **1**

_____

2016 Q21a

21. A software developer is creating an online booking system for a bowling alley. Customers can book a bowling lane for a maximum of 4 people playing a maximum of 3 games.

The developer has used a flow chart to produce the program design. Part of the design is shown below.



(a) (i) State **one** benefit of using the design notation shown above instead of pseudocode. **1**

(ii) Name the algorithm illustrated in the bowling alley program design. **1**

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DESIGN

Exemplify and implement one of the above the design techniques to design efficient solutions to problems

16. Pam is creating an application that will find and display a person's tax rate based on their salary.

Salary	Tax rate
0–12000	0
12001–40000	20
40001 upwards	40

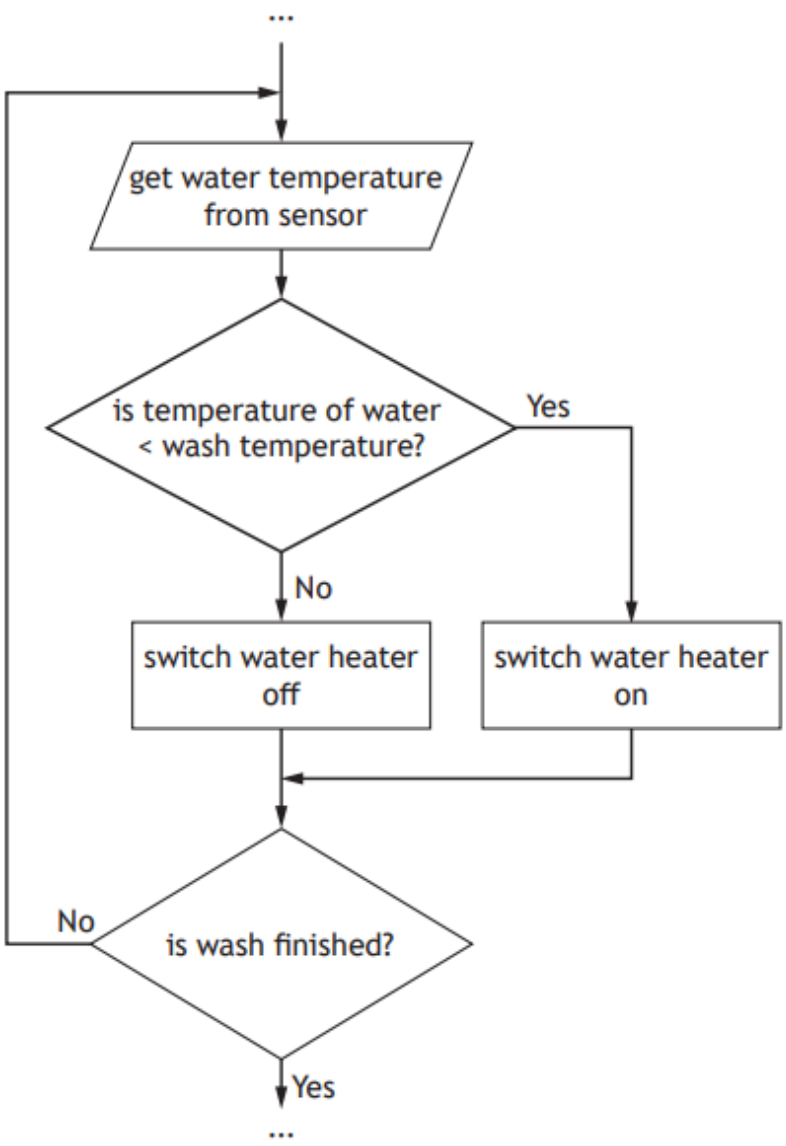
(b) Using a design technique of your choice, design an efficient solution to the problem of finding a person's tax rate. **4**

2019 16c

16. A program to control the water temperature inside a washing machine is being designed. The user will select a wash temperature using the control panel on the machine.

The program should ensure that the water stays heated at the correct temperature throughout the wash.

The design for the part of the program that maintains the water temperature is shown below.



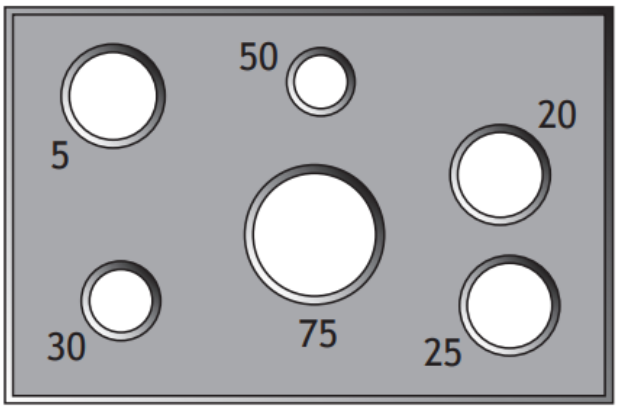
(c) When the wash is finished, the water will drain out. A sensor continuously detects the amount of water in the machine during the draining process. When there is no more water in the machine the door will automatically open.

Using a design technique of your choice, design a solution to this problem. **3**

2019 Q19b(ii) – b(i) included for reference

19. A fairground game involves throwing balls through holes in a large wooden board. Each hole scores different points.

The game is played using the following four rules.



1. A player starts with 3 balls and throws them one at a time.
2. If a ball is successfully thrown through a hole the points are added onto the player's score.
3. The game ends immediately if a player's score is greater than or equal to 50.
4. If the score reaches exactly 50 points the player is told they have won a prize.

A program is written to keep the score for a player.

```
...
Line 3    DECLARE total INITIALLY 0
Line 4    DECLARE balls INITIALLY 3
Line 5    WHILE total < 50 AND balls > 0 DO
Line 6       RECEIVE ballScoreOne FROM KEYBOARD
Line 7       SET total TO total + ballScoreOne
Line 8       SET balls TO balls - 1
Line 9       RECEIVE ballScoreTwo FROM KEYBOARD
Line 10      SET total TO total + ballScoreTwo
Line 11      SET balls TO balls - 1
Line 12      RECEIVE ballScoreThree FROM KEYBOARD
Line 13      SET total TO total + ballScoreThree
Line 14      SET balls TO balls - 1
Line 15   END WHILE
Line 16   SEND "Well done! You have won a prize." TO DISPLAY
```

(b) The program runs but does not meet the functional requirements stated in the rules.

(i) State the type of error that has occurred. **1**

_____

19. (b) (continued)

(ii) The program has been edited as shown, but still breaks rule 3 and rule 4 of the game.

```
...
Line 3    DECLARE total INITIALLY 0
Line 4    DECLARE balls INITIALLY 3
Line 5    WHILE total < 50 AND balls > 0 DO
Line 6       RECEIVE ballScore FROM KEYBOARD
Line 7       SET total TO total + ballScore
Line 8       SET balls TO balls - 1
Line 9    END WHILE
Line 10   SEND "Well done! You have won a prize." TO
          DISPLAY
```

Using a design technique of your choice, design a solution that meets the requirements of all four game rules. **4**

2018 Q19d

19. (continued)

(d) Using a design technique of your choice, design an efficient solution to ensure that a password of only 8 characters can be entered.

An error message should be displayed if the incorrect number of characters is entered, and the user asked to re-enter the password. **4**

2018 Q21a

21. A program will calculate the total cost when customers purchase tickets to a theme park.

Adults pay £25 per ticket; children pay £10. If there are two or more adults with more than two children a discount of £5 is subtracted from the total cost.

Algorithm

1. Store cost of adult and child ticket
2. Get name of person making booking
3. Get quantity of tickets
4. Calculate total cost
5. Display food voucher message

Refinement

2.1 Get first name
2.2 Get second name

3.1 Get quantity of adult tickets
3.2 Get quantity of child tickets

(a) Using a design technique of your choice, refine step 4. **6**

2016 Q12

12. A running group has 16 members. They are taking part in a marathon.

Using pseudocode or a programming language of your choice, write the code which will take in each runner's time for the marathon. **2**

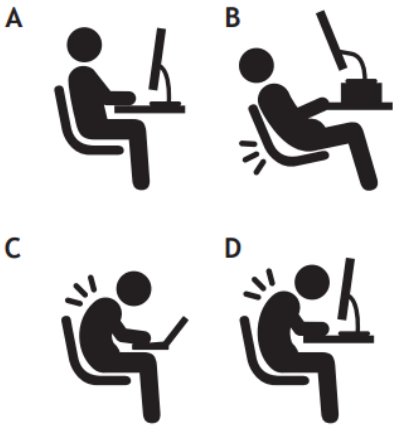
2016 Q18d(ii)

18. A software development company decides to review staff knowledge of computer related legislation.

Mikal is asked to create an app covering a range of legal issues.

(d) In line with Health and Safety legislation, the company provides adjustable seating and guidelines on maintaining good posture.

Mikal finds graphics on a website that he can use to illustrate his next quiz question.



(i) Explain why he might need to seek permission to use the graphics legally. **1**

DESIGN

Describe, exemplify, and implement user-interface design, in terms of input and output, using a wireframe.

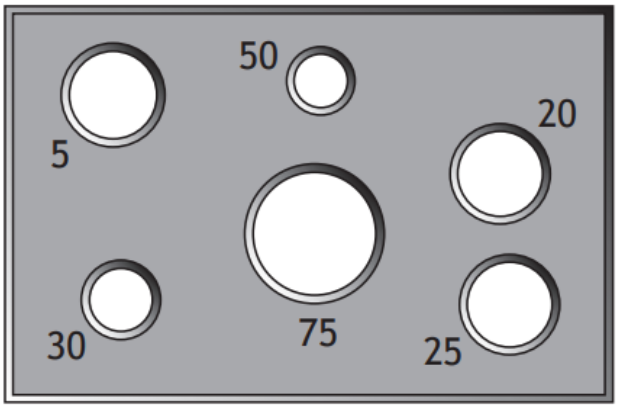
2019 Q3

3. A bank requires a program for loan applications. The user will enter how much money they want to borrow and the number of monthly repayments. The user will then be informed how much they must repay each month.

Using the information above, design a user interface for the program. **3**

19. A fairground game involves throwing balls through holes in a large wooden board. Each hole scores different points.

The game is played using the following four rules.



1. A player starts with 3 balls and throws them one at a time.
2. If a ball is successfully thrown through a hole the points are added onto the player's score.
3. The game ends immediately if a player's score is greater than or equal to 50.
4. If the score reaches exactly 50 points the player is told they have won a prize.

A program is written to keep the score for a player.

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Line 3    DECLARE total INITIALLY 0
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Line 7       SET total TO total + ballScoreOne
Line 8       SET balls TO balls - 1
Line 9       RECEIVE ballScoreTwo FROM KEYBOARD
Line 10      SET total TO total + ballScoreTwo
Line 11      SET balls TO balls - 1
Line 12      RECEIVE ballScoreThree FROM KEYBOARD
Line 13      SET total TO total + ballScoreThree
Line 14      SET balls TO balls - 1
Line 15   END WHILE
Line 16   SEND "Well done! You have won a prize." TO DISPLAY
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19. (b) (continued)

(ii) The program has been edited as shown, but still breaks rule 3 and rule 4 of the game.

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Line 7       SET total TO total + ballScore
Line 8       SET balls TO balls - 1
Line 9    END WHILE
Line 10   SEND "Well done! You have won a prize." TO
          DISPLAY
```

Using a design technique of your choice, design a solution that meets the requirements of all four game rules. **4**