Producing robust programs

Input sanitisation and validation

Assume the user will input data incorrectly

PLANNING FOR CONTINGENCIES

What happens if it goes wrong? What error message do you want to appear?

ANTICIPATING MISUSE

Put yourself into the mind of your users and make the system as simple to use as possible. Use menus or short codes rather than entire words to cut down on potential spelling errors. If possible, make sure it is not case sensitive.

AUTHENTICATION

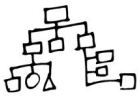
Ensuring only users who have the right to use that program can have access to it. Use email checks, passwords etc.

Code within sub programs or iterations should be **indented**. Some programs will not run unless correct indentation is used.

Comments provide information about what the different parts of the program do

Maintainability

Ensuring other programmers can make sense of the program you have written



You should select **variable names** that reflect the purpose or contents rather than short difficult to understand abbreviations

Logic errors

A **logic error** is a problem with the way a program works and the route it will follow through a program. Logic errors can have many causes, such as:

- Incorrectly using logical operators, eg expecting a program to stop when the value of a variable reaches 5, but using <5 instead of <=5
- Unintentionally creating a situation where a loop will keep repeating and it cannot break out of it; this is known as an infinite loop
- Incorrectly using brackets in calculations
- Unintentionally using the same variable name at different points in the program for different purposes

VALIDATION CHECKS

Validation Type	Description
Range check	the input must fall within a specified range. This is usually applied to numbers and dates but can apply to characters. For example, when making a payment to someone the amount to be entered might be set to be greater than zero and not greater than the funds available.
Length check	the input must not be too long or too short. For example, a surname will require at least one letter, but is unlikely to require more than 40.
Presence check	a data value must be entered. For example, entering a quantity when placing an order.
Format check	the data must be in the correct format, such as entering a date in the format DD/MM/YYYY.
Type check	the data must be of a specified data type, such as an integer when specifying a quantity.

Validation does not ensure that the data entered is correct, just that it is possible and sensible

TESTING

A programmer must thoroughly test their program to spot syntax and logic errors and correct them. This is usually done in two stages:

Iterative testing

Carried out while a program is being developed. The programmer writes a section of code then tests it.

Final/terminal testing

Carried out when all sections of the program is complete. The program is tested by running through it several times to test out different scenarios.

Syntax errors

A **syntax error** occurs when code does not follow the rules of the programming language, this includes:

- misspelling a word eg writing “iput” instead of “input”
- using a variable in a statement before it has been created or declared
- missing brackets, speech marks to another grammatical error that code will be expecting etc.

Selecting and using suitable test data

Test data should cover a range of possible and impossible inputs

- **Valid data** -sensible, possible data that the program should accept and be able to process
- **Extreme data** and **range check** - valid data that falls at the boundary of any possible ranges
- **Invalid (erroneous) data** - data that the program cannot process and should not accept

№	Data to test	How it is tested	Expected outcome	Actual outcome	Pass/Fail
1	num	**Valid data** – (15)	Counts from 1 to 15	Counts from 1 to 15	Pass
2	num	**Presence check** – leave num blank	“Invalid entry”	“Invalid entry”	Pass
3	num	**Invalid data** – enter a string (“Hello”)	“Invalid entry”	“Invalid entry”	Pass
4	num	**Range check** – enter a number outside range (2)	“Invalid entry”	“Invalid entry”	Pass
5	num	**Extreme data** – data on the edge of the range (10)	Counts from 1 to 15	“Invalid entry”	Fail

A **test table** is used to record the results of the tests that are performed

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Revise it

Read through the handout and then select a revision technique from those described in this section, you can even do more than one if you want!

Highlight

Highlight key words (maximum of 2 per sentence) and then cover the page and try to write down all the key words you can remember. Go back and fill in all the ones you have missed.

Mind map

Using the handout, draw a mind map and include as many colours, images and diagrams as you can to illustrate it

Post-it notes

Write a key word and the definition on a post-it note and stick them around your study area as a reminder of the terminology.

Record your notes

Re-write the handout in your own words and record yourself using your phone as you read your notes aloud.

Bullet Points

Write the main headings (leaving space between each) and then write bullet points of the main key points you need to remember under each heading. Re-read the handout and add any missed points to your list.

TEST YOURSELF

Cover your notes and the answer before you attempt to answer BOTH PARTS of this practice exam question.

a) Explain the difference between iterative testing and final testing *[2 marks]*

b) Draw a test table to show how the following program can be tested [6 marks]

```
INPUT num
IF num >= 10 and <= 20 THEN
   PRINT "Thank you"
ELSE
   PRINT "Invalid value"
END IF
```

Mark your answer

For part a give one point for each correct point made, maximum 2 points. For part b give 1 point for including each of the following point identified in the test table, maximum 6 points.

Part a:

- Iterative testing involves testing sections of the program as it is created and can involve many tests
- Final testing involves testing the the program once it is completed

Part b:

- Identify the data to be tested (num)
- Include a test for valid data (between 10 and 20)
- Include a test for presence check (leave num blank)
- Include a test for extreme data (10 or 20)
- Include a test for range check (less than 10 or more than 20)
- Include an expected and/or actual outcome for each test