**CfE Computing Science: Software Design and Development**

*Languages and Environments:*

* Low-level
* High-level
* Procedural
* Declarative
* Object-oriented

Q1. Describe the difference between a low-level and a high-level language.

Q2. State the three different types of control structures. Describe an example for each type given.

Q3. Describe one advantage each of using an interpreter and a compiler for translation.

Q4. Describe how a procedural language works.

Q5. Describe how a declarative language works.

Q6. Describe how inheritance can be a benefit to an object-oriented language.

*Computational Constructs:*

* Parameter passing
* Scope, local and global variables
* Sub-programs/routines, defined by their name and arguments including
  + Functions
  + Methods
  + Procedures

Q1. With reference to local and global variables, describe the term scope.

Q2. Explain why it is encouraged to avoid unnecessary use of global variables when programming.

Q2. Describe the difference between passing by a value parameter and a reference parameter.

Q3. Describe when a formal parameter is used.

Q4. Describe when an actual parameter is used.

Q5. Explain the term function.

Q6. Describe the difference between a function and a procedure.

*Data types and structures:*

* String
* Numeric (integer and real) variables
* Boolean variables
* 1-d arrays and records (including arrays of records)
* Sequential files (open, create, read, write, close)

Q1. Describe the difference between an integer and a real data type.

Q2. Describe the difference between a character and a string data type.

Q3. State what data type is used to store floating point notation.

Q4. Describe how sequential files are stored.

Q5. Explain what a Boolean variable is.

Q6. Describe what is meant by string concatenation.

Q7. State two operations that can be executed on a sequential file.

*Testing and Documenting Solutions:*

* Constructing a test plan
* Comprehensive testing
* Syntax, execution and logic errors
* Dry runs, trace tables/tools, breakpoints

Q1. State the three different types of programming errors. Describe an example for each.

Q2. With reference to test data, describe what a test plan is.

Q3. Suggest test data that can be used to test a program that checks if a number is between 1 and 100.

Q4. Suggest an advantage of using a trace table.

Q5. Describe what a dry run is.

Q6. Describe how breakpoints can be used when programming.

*Algorithm Specification:*

Analysis, exemplification and implementation of algorithms including:

* Input validation
* Linear search
* Find minimum and maximum
* Count occurrences
* Algorithms of similar complexity

Q1. Describe the difference between a conditional loop and an unconditional loop.

Q2. Describe the difference between a 1-D array and a 2-D array.

Q3. Describe the term input validation.

Q4. Using pseudocode or a programming language of your choice, write a program that will validate a user’s input so that they enter a number between 1 and 10.

Q5. Using pseudocode, write an algorithm used to find the maximum value in an array.

Q6. Using pseudocode, write an algorithm used to find the minimum value in an array.

Q7. Explain why the linear search algorithm requires use of a Boolean variable.

*Low-level Operations:*

* Virtual Machines
* Emulators
* Mobile devices
* Use of binary to represent - Integers and real numbers, Characters, Instructions, Graphics, Sound, Video

Q1. Convert the following decimal numbers into 8-bit two’s complement:

12 48 -54 -36 99

Q2. Describe the effect of allocating more bits to the exponent in floating point notation.

Q3. Describe the effect of allocating more bits to the mantissa in floating point notation.

Q4. Describe how a bit-mapped graphic is stored.

Q5. Describe an advantage and disadvantage of storing graphics as bitmaps.

Q6. Describe the difference between lossy and lossless. Suggest a file format for each to store an image.

Q7. Explain how vector graphics are stored.

Q8. Describe an advantage and disadvantage of storing graphics as vectors.

Q9. Describe how bit-rate and sample-rate can affect the size of a sound file.

Q10. Explain why an emulator is required in the programming environment.

*Computer Architecture:*

* Processor (registers, ALU, control unit)
* Cache
* Memory
* Buses (data and address)
* Interfaces

Q1. State the three different parts of a processor. Describe each parts’ role.

Q2. State what way the address bus can travel.

Q3. With reference to the buses, describe the process of a memory read operation.

Q4. Describe what effect the width of the data bus can have.

Q5. Describe the steps involved in the fetch execute cycle.

Q6. Describe what effect increasing the clock speed of a processor can have.

Q7. State what the MIPs and FLOPs stand for.

Q8. State what type of RAM is used for cache memory.

Q9. Describe an advantage of storing instructions in cache memory rather than main memory.