Month 1, Week 3 revision questions.

Total points 19/20

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19 of 20 points

✓ One of these programming languages is a low-level language: 1/1

- Python
- Java
- ✓ Assembly
- Ruby

✓ Compilers and interpreters convert programs written in other languages to binary (machine language). 1/1

- ✓ True
- False

Feedback

Correct!

The only language understood by a computer is binary a.k.a. machine language. Every other language, both compiled and interpreted languages, are converted to this machine language before they can be executed by the computer. Compiled languages use compilers while interpreted languages use interpreters.

✓ How many bits make 1 byte? 1/1

- 6
- 16
- ✓ 8
- 24

✓ A network has a speed of 50Mbps (megabits per second). How long will it take to download a file of 250MB? 1/1

Hint: 50Mb = 50 x 10^6 bits.

- 100 seconds
- ✓ 40 seconds
- 1024 seconds
- Omooo x 100

Feedback

Correct!

STEP 1: Make all units to be uniform i.e. convert 50Mb to bytes OR convert 250MB to bits.

If you choose to convert 50Mb to bytes:

50Mb = 50 x 10^6 = 50 000 000 bits
50 Mb = (50 000 000 / 8) bytes = 6 250 000 bytes = 6.25MB

STEP 2: Form a relationship or ratio between the network speed and time.

If 50Mb = 6.25MB, that means the network speed is also 6.25MBps (megabytes per second).

Since 6.25MB takes 1 second, 250MB will take x seconds. In essence,

6.25MB : 1 second, 250MB : x seconds

(6.25 / 1) = (250 / x)

*250 * 1 = 6.25x*

Making x subject of formula:

*x = (250 * 1) / 6.25 = 40 seconds.*

Therefore, a file of 250MB would take 40 seconds to download.

✓ Which of these best describes a variable in programming? 1/1

- ○ A variable is synonymous to a data type that occupys 4 bytes of memory.
- ○ A variable is a string with multiple characters.
- ◉ A varible is a like a container used to store a value. ✓
- ○ A variable means the absence of a value.

✓ What data type is the value: -12.5? 1/1

- ○ Integer
- ◉ Floating point number ✓
- ○ Boolean
- ○ String

Feedback

Correct!

Floating point numbers are numbers with a decimal part. In this situation, -12.5 has a decimal part: .5 and so is classified as a float.

Note that -12.5 and "-12.5" are not of the same data types.

-12.5 is a float.
"-12.5" is a string.

✗ Dynamic type checking is carried out for compiled languages. 0/1

- ◉ True ✗
- ○ False

Correct answer

- ◉ False

Feedback

Dynamic type checking is carried out during runtime. In essence, the code will run but will immediately throw an error when the interpreter encounters a mismatch. This is seen in interpreted languages e.g. Python, JavaScript.

✓ Which of these data structures uses a LIFO method to add and remove data from it? 1/1

- ○ Arrays
- ○ Linked lists
- ◉ Stacks ✓
- ○ Queues

✓ Which data structure stores data using key-value pairs? 1/1

- ◉ Hash tables ✓
- ○ Trees
- ○ Linked lists
- ○ Arrays

✓ Which of these data structures consist of nodes, where a node is connected to another node using a pointer? 1/1

- (•) Linked lists ✓
- ( ) Hash tables
- ( ) Queues
- ( ) None of the above

✓ An algorithm with constant running/execution time is (pick all answers that apply): 1/1

- [ ] an algorithm whose execution time is directly proportional to the size of input.
- [ ] an algorithm with execution time O(n).
- [x] an alogorithm whose execution time is not affected by the size of its input. ✓
- [x] an algorithm with execution time O(1). ✓

Feedback

Correct!

An algorithm with constant running time is an algorithm whose running time will always be the same no matter the size of input. In essence, running time is not affected by size of input. It has a running time of Big O of 1 i.e. O(1).

✓ Which of the following best describes recursion in Computer Science? 1/1

- ( ) Recursion is what happens when an algorithm or function runs repeatedly.
- ( ) Recursion is a condition that evalutes to both true AND false.
- (•) Recursion is a form of function implementation in which during the execution of the function, the function calls itself. ✓
- ( ) All of the above

✓ Which of these operating systems is open source? 1/1

- (•) Linux ✓
- ( ) iOS
- ( ) Windows
- ( ) MacOS

✓ The type of programming paradigm that allows us to create entities that can model real-life objects is called? 1/1

- ( ) Functional programming
- ( ) Procedural programming
- (•) Object-oriented programming ✓
- ( ) None of the above

Feedback

Correct!

OOP allows us to create entities called classes that can represent real-life objects. We can assign data (called attributes) and actions (called methods) to these classes that represent the actions and attributes of the real-life object.

✓ A text editor is a software used to write, debug AND compile code. 1/1

- ( ) True
- (•) False ✓

Feedback

Correct!

A text editor cannot be used to write, debug AND compile code. A software that can do all three is called an IDE (Integrated Development Environment).

✓ In order to carry out binary search on a collection of data, that data has to be: 1/1

- Compressed
- Sorted ✓
- Entangled
- All of the above

✓ A major concept in OOP that involves hiding complex logic and implementation from the user, where the user just needs to call methods or use attributes without needing to know how things work underneath the hood is called? 1/1

- Polymorphism
- Inheritance
- Secrecy
- Abstraction ✓

✓ Big O notation is ONLY the representation of the amount of time it takes an algorithm to execute. 1/1

- True
- False ✓

Feedback

Correct!

Big O is a representation of the amount of time it will take an algorithm to execute AND the amount of space in a computer's memory the algorithm will utilize during execution in the worst-case scenario of input.

✓ The programming construct that allows a code block to run repeatedly until a condition is met is called: 1/1

- Function
- Loop ✓
- Condition
- Boolean expression

✓ What is a function in programming? 1/1

- A block of code that runs repeatedly.
- A block of code that performs a specific task. ✓
- An expression that evaluates to true or false.
- None of the above

Advanced questions 0 of 0 points

Attempt this section only if you feel more comfortable with Big O notation. The scores will not count.

✕ What is the time and space complexity of the following code?

```c++
int a = 0, b = 0;
for (i = 0; i < N; i++) {
    a = a + rand();
}
for (j = 0; j < M; j++) {
    b = b + rand();
}
```

- ○ O(N * M) time, O(1) space
- ◉ O(N + M) time, O(N + M) space ✕
- ○ O(N + M) time, O(1) space
- ○ O(N *M) time, O(N + M) space

Correct answer

- ◉ O(N + M) time, O(1) space

Feedback

For time complexity:

We have 2 adjacent loops.

The first loop will run for N times (notice the condition i < N).
The second loop will run for M times (notice the condition j < M) .

Since they are adjacent loops, it means the first loop will run completely before the second loop will begin to run and complete. In essence, the total number of steps (time) it will take is N + M steps.

For example:
If N = 5, the first loop will run 5 times.
If M = 10, the second loop will run 10 times.

Therefore the total number of steps = N + M = 15 steps.

It is worthy to note that time and space complexity is generally an approximation and not really the actual time and space it will take to finish executing an algorithm. An approximation on the scale of the actual value is totally fine.

For space complexity:

Two variables , a and b, were declared at the beginning of the code. This declaration will never change no matter the size of input or the size of N and M. It will always be constant.

Therefore, the code occupies O(1) space.

Note that within the individual loops, new variables were not declared. The previous values in the variables were just replaced on each iteration.

Another thing you might consider is the rand() function. Depending on how this function was implemented, the time complexity might change. But we are not exposed to how this was defined, so we are not bothered at this point by the implementation details.