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Assignment 1

1. [9 pts] Define the von Neumann's architecture. Include both how a von Neumann machine is wired and the process used to execute programs.

   Computers are permanently hardwired with a small set of general purpose operations. Data and programs are stored in the same memory. Instrctions are transmitted from memory to cpu, and results are sent back

2. [9 pts] Define the von Neumann Bottleneck and explain how it is related to the Processor-Memory performance gap.

   limited throughput between cpu and memory restricts transfer of data

3. [9 pts] List the computational paradigms discussed *in class*.

   Imperative, functional, logic, scrpting, and object-oriented languages

4. [9 pts] How are compilers and interpreters similar? How are they different?

   Both compilers and interpreters translate high-level language into machine code. However, compilers are substantially more complicated than assemblers, as they translate before execution as opposed to during runtime

5. [9 pts] What two language design criteria focus areas would you prioritize when designing a programming language? Why?

   Regularity, as it covers generality, orthogonal design, and uniformity all at once. Then efficiency, so it's maintainable and user friendly

6. [9 pts] Discuss two or more examples of efficiency in the Java programming language. Specify if your example is computational efficiency or programmer efficiency.

   The removal of pointers as a benefit to programmer efficency, and just-in-time compilation increases computational efficiency

7. [9 pts] Discuss two or more examples of inefficiency in the Java programming language. Specify if your example is computational efficiency or programmer efficiency.

   The lack of a basic english language structure hinders programmer efficiency, as well as the requirement for a more complicated runtime environment which hurts computational efficiency

8. [9 pts] Discuss two or more examples of regularity in the Java programming language.

   Java can compare two structures with == which is good for generality. Java also allows all data types to be returned, which helps orthogonality.

9. [9 pts] Discuss two or more examples of irregularity in the Java programming language.

   Arrays are the only collection structure that can contain primitive types. Overloaded methods are also irregular as it produces ambiguities in the code

10. [10 pts] Should a language require the declaration of variables? Languages such as Lisp and Python allow variables names to be used without declarations, while C, Java, and Ada require all variables to be declared. Discuss the requirement that variables should be declared from the point of view of readability, writability, efficiency, and security.

    The declaration of variables provides a designated location in code to refer to for intializations and value checks, which helps with general efficiency. It also helps with security by type checking

11. [9 pts] List the two types of programming language abstractions and the three levels of programming language abstractions

    Types: Data and control abstractions
    Levels: Basic, structured, and unit abstractions