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CS 472 HW 1

(1.3) We said that the pattern of 1s and 0s used to represent an instruction in a computer has no intrinsic meaning. Why is this so and what is the implication of this statement?

Binary words mean nothing to the computer, the only meaning that is given to a particular set of binary values is specified by the programmer when writing a program or function. This means that the same value could mean one thing on one computer and something entirely different on another computer. Essentially, a CPU does not understand a binary pattern, but it does know what to do with that binary pattern.

(1.5) Modify the algorithm used in this chapter to locate the longest run of non-consecutive characters in the string.

1. Read the first digit in the string and call it New_Digit
2. Set the Current_Run_Value to New_Digit
3. Set the Current_Run_Length to 1
4. Set the Max_Run to 1
5. REPEAT
6. Read the next digit in the sequence (i.e., read New_Digit)
7. IF its value is the same as Current_Run_Value
8. THEN Current_Run_Length = 1
9. ELSE {Current_Run_Length = Current_Run_Length + 1
10. Current_Run_Value = New_Digit}
11. IF Current_Run_Length is greater than Max_Run
12. THEN Max_Run = Current_Run_Length
13. UNTIL The last digit is read

(1.8) What are the differences between RTL, machine language, assembly language, high-level language, and pseudocode?

RTL: Register Transfer Language. A notation and form of pseudocode that makes it easier to define computer operations.

Machine language: The lowest-level instructions that are directly executed by the CPU. This is the type of code that is typically output by a compiler.

Assembly language: The human-readable version of machine code that specifies registers and operations.

High-level language: A programming language with a degree of abstraction from the underlying computer. Many of these languages include some automation and hide details about the underlying processes, such as memory management.

Pseudocode: An informal, high-level description of a computer program. Pseudocode is very human readable and often omits details that are not necessary for understanding of an algorithm, such as variable declarations.

(1.12) What is the difference between a computer's *architecture* and its *organization*?

Architecure: The programmer's view of a computer at the level of the assembly language. It is an abstract view of the system, and the physical hardware is hidden from this view point. This is also known as a computers abstract instruction set architecture (ISA).

Organization: The physical implementation of a computer's architecture using real gates and circuits. This is the actual hardware of the computer, as well as the entire computer, including the processor, memory, I/O devices, etc.

(1.18) What is the von Neumann bottleneck?

In a stored program computer, instruction execution requires at least two memory accesses. The CPU must access memory first to read the instruction, and then at least once more to follow the memory access specified by the instruction. In this model, then, the path between the CPU and memory is a bottleneck.

(1.33) Is Moore's law a law?

No, its just an empirical observation made by Intel co-founder Gordon Moore that the number of transistors per square inch on an integrated circuit chip had doubled every 18 months since its invention. A law is a statement of fact that always remains true, and this is certainly not the case with transistor density. At some point, we will reach the physical limits and not be able to pack any more transistors on a chip.