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ECEN3213 Homework 1 Spring 2022

**Due Date: 11:59pm Monday, Feb. 7th, 2022 through Canvas
(Total 50 Points)**

1. Briefly explain how the ARM company sells its product, the ARM processor design? (5 points)

ARM is a processor Design and they licenses the Designs to Other Companies that then use the ARM Design along side their own semiconductor Technology on their Chips

2. To make an instruction set, what types of instructions do you need at a minimum? (5 points)

Assembly Code

3. What is the difference between a Von Neumann architecture and a Harvard architecture? (5 points)

Von - Neumann : Instructions & Data are Stored in the Same Memory

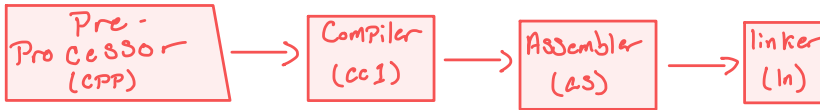
Harvard : Instructions & Data are Stored in Separate Memory

4. Explain the function of the PC and IR registers in the control unit of a processor. (5 points)

The PC or Program Counter Points to the next Instruction

While the IR or Instruction Register holds the fetched Instruction

5. What are the four stages when compiling a C program using gcc? (5 points)



6. A particular instruction set has 120 different instructions. How many bits are needed to encode the operation codes (opcode) at least? (5 points)

7 bits

7. Compare the pros and cons of C/C++ language vs. assembly language in software development for a computer-based system (5 points)

C/C++

Pros	Cons
High level language	
Closer to Problem Domain	
Closer to English language	

Assembly language

Pros	Cons
	Not a structured language
	does not directly support loops
	easy to generate Spaghetti Code

8. What is the impact of the invention of transistor on the evolution of computers? (5 points)

It was Smaller and faster
and increased memory
also used Assembly and Machine Language

9. Given the following memory map for an ARM processor, answer the questions: (10 points)

Data	Address
	0xFFFFFFFF
4770	0x080001B4
2000	0x080001B2
188B	0x080001B0
2201	0x080001AE
2100	0x080001AC
	0x00000000

1) What is the total capacity of the memory in terms of bytes? (2 point)

$$8 \times 4 = 32 \text{ bits}$$

$$2^{32} = 4 \text{ GB}$$

- 2) What is big endian and what is little endian in terms of how to store the instructions in the memory? What is the default endian used in ARM processors? (4 points)

ARM uses Little Endian

- 3) If $PC=0x080001B0$ and assume the instruction set is using 16-bit encoding, what will be the new PC value after the current instruction is executed? (2 points)

$0x080001B4$

- 4) If $PC=0x080001B0$ and assume the instruction set is using 32-bit encoding, what will be the new PC value after the current instruction is executed? (2 points)

$0x080001B2$