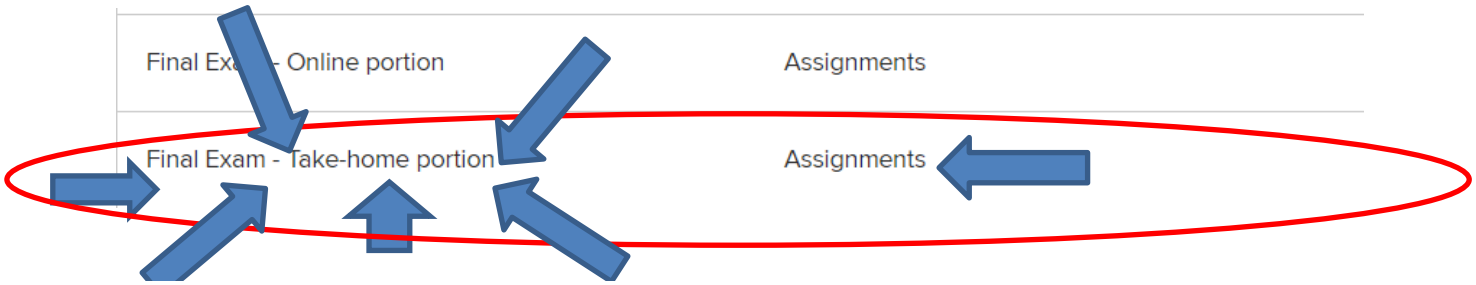
Final Exam - Take-home portion

Due Date: Friday 6/18/2021 at 11 PM EST

Must be submitted to the "Final Exam - Take-home portion"

Submission: You are required to submit one single "pdf" file.

Deduct 5 points if submitted to the wrong place. See below…



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You are required to propose complete processor/memory architecture to be used in a certain application. Initially, you need to propose a name for your new architecture and explain what application your proposed architecture will be used in.

1. Identify a set of processor parameters and structures.

You need to define the components, unique parameters, and instruction set for your proposed processor structure. To determine the instruction set, you will have to create your own set of instructions that your processor can handle.

In your proposed architecture, specify the following:

1.1 Processor architecture and instruction set:

I. Determine the processor components and the characteristics for each component.
   - Components may be any internal hardware that your proposed processor may have, such as a special arithmetic unit.

II. Determine how many registers there are in your computer architecture.

- You have to specify how many registers are in your proposed processor, their names, and their sizes. You may have three registers A, B, and C. Each register is 8 bits. You do not have to stick with the MIPS structure given in the course.

III. Determine the instructions that your proposed processor can handle.
- You have the freedom to determine how many instructions your proposed processor can handle. You have to have more than ten instructions. Your instructions can be anything, including instructions such as add, sub, and mul.

IV. Determine the instruction size.
- Determine the size of your proposed instruction set. You may choose to have a varying or fixed instruction set size. Discuss why you selected that type of instruction set.

1.2 Instruction type and format:

I. Determine how many instruction types your processor will support.

- The instruction types can be R-type for arithmetic, J-type for jump, or any other types you would like. You may have one type or more.

II. Determine the format of each type.

- For each instruction type, determine the size and the format. You may use the same format for all types, or different formats for each. For each format, determine how many fields it has, and the size of each field. For example, you may have three fields with each field being six bits. That will give you an eighteen bit instruction. The first field may be the op-code, the second field may be the source register, and the third field may be the destination register.

1.3 Processor architecture and characteristics

I. You need to determine single core vs multicore and the multithread support or not and why and how the multithread, that your proposed processor has, is supported.
II. Processor Pipelining stages (how many stages and the functions in each stage), pipelining hazards that may appear in your proposed processor, and how you are going to overcome these hazards.

2. Identify the memory structure for your proposed architecture.

You should define the memory size, unique parameters, and the instructions that deal with the memory. You need to determine the cache levels and how cache works in your proposed structure.

In your proposed architecture, specify the following:

2.1 Determine the memory structure used in your computer architecture.

- You may choose to have a unified memory for both data and instructions or you may prefer a separate memory for each. You are required to justify why you chose a specific architecture.

2.2 Determine the size of your proposed memory. .

2.3 Determine what instructions can access the memory and how.

2.4 Determine the cache levels.

- You may choose to have one or more cache levels. In each cache level, you have to determine if this level is a unified or a separate cache for both data and instructions. In addition, you have to select the cache size for each level. You are required to justify why you chose a specific architecture.

2.5 Determine how cache works.

- Determine how to locate a block in the cache, and how to choose a block to be replaced from the cache. You are required to justify why you chose a specific architecture.

2.6 Propose a similar memory sharing protocol similar to the snoopy protocol.

Final Exam (Take Home):
- Majority of the questions need to be answered. You cannot just say 'N/A' for all questions. I trust you ;)
- You can use whatever you proposed in assignment 2 if you want and add to it.
- Any application is fine (practical or not).