Introduction to Computer Architecture: Supervision 1

Lectures covered by the supervision: https://www.cl.cam.ac.uk/teaching/2223/IntComArch/

- Lecture 1: Technology trends and design challenges. Current technology, technology trends, ECAD trends, challenges.
- Lecture 2: Digital system design. Practicalities of mapping SystemVerilog descriptions of hardware (including a processor) onto an FPGA board. Tips and pitfalls when generating larger modular designs.
- Lecture 3: Eight great ideas in computer architecture.
- Lecture 4: Reduced instruction set computers and RISC-V.

Past exam questions:
https://www.cl.cam.ac.uk/teaching/exams/pastpapers/t-ComputerDesign.html

Supervision questions:
1. **Answer 2010 P5 Q2** - parts (a) and (b). Make sure to additionally comment:
   a. What enables Moore's law?
   b. Explain relationship between Moore's law and performance of processors:
      i. In terms of frequency.
      ii. If we ignore increases in frequency, what does an increased number of transistors enable in terms of performance?
   c. Explain the relationship between Moore's law and Dennard's scaling before 2006 and after 2006.
   d. What are the real-world consequences of the Dennard's scaling breakdown?
   e. Explain the phenomena of dark silicon.

2. **Answer 2021 Paper 5 Question 1**

3. **Answer 2017 P5 Q1**.
   a. What is SystemVerilog? What are other similar languages?

4. **Answer 2016 P5 Q1** – parts (a) and (c). Make sure to additionally comment:
   a. What is meta-stability of D flipflops and how does it occur?

5. Describe the steps that transform a program written in a high-level language such as C into a representation that is directly executed by a computer processor.

6. Explain the term "Instruction Set Architecture - ISA", and why does ISA matter?

7. Explain what are FPGAs and how they are able to enable creation of custom accelerators.
   a. Discuss cases in which FPGAs perform faster than general CPUs. What enables FPGAs to be faster?
   b. Discuss cases in which FPGAs perform slower than general CPUs. What makes FPGAs slower?
   c. Compare FPGAs and general CPUs in terms of programming and power consumption.

8. Consider the function below and re-write it using appropriate assembly instructions (RISC-V if possible. Syntax is less important; it is rather more important that you understand the logic of how processor executes instructions):

   ```
   int f(int a, int b, int c)
   {
       if(a)
           return c;
       return a+b;
   }
   ```
- Try to use: objdump -d <binaryName>”. Compare it with your attempt.
9. Discuss each of the “eight great ideas in computer architecture” mentioned in the lectures. Focus on performance, power consumption, and dependability. Try to differentiate, which of these ideas requires participation of software engineers, and which one of them implicitly improves mentioned quality properties.
10. Summarize the main message from lesson 1 in 1-3 sentences?
11. Summarize the main message from lesson 2 in 1-3 sentences?
12. Summarize the main message from lesson 3 in 1-3 sentences?
13. Summarize the main message from lesson 4 in 1-3 sentences?

Save your answers into MS Teams or email them to me. Please use the following naming pattern:
ICA_Supervision_1_Answers_<last name>_<<first name>>.Michaelmas_2022
Send your answers as a pdf, doc, image, or any other format of a document for which there exists an easily available software to open.

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