CSCI 4591: Computer Architecture
HW Assignment # 3

Due Date: February 21, 2021 @ 12:55 PM

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1) The eight great ideas in computer architecture are similar to ideas from other fields. Match the eight ideas from computer architecture, "Design for Moore's Law", "Use Abstraction to Simplify Design", "Make the Common Case Fast", "Performance via Parallelism", "Performance via Pipelining", "Performance via Prediction", "Hierarchy of Memories", and "Dependability via Redundancy" to the following ideas from other fields:

    1) Assembly lines in automobile manufacturing
        - Performance via pipelining
    2) Suspension bridge cables
        - Dependability via redundancy
    3) Aircraft and marine navigation systems that incorporate wind information
        - Performance via prediction
    4) Express elevators in buildings
        - Performance via parallelism
    5) Library reserve desk
        - Make common case fast
    6) Increasing the gate area on a CMOS transistor to decrease its switching time
        - Hierarchy of memories
    7) Adding electromagnetic aircraft catapults (which are electrically powered as opposed to current steam-powered models), allowed by the increased power generation offered by the new reactor technology
        - Design for Moore's Law
    8) Building self-driving cars whose control systems partially rely on existing sensor systems already installed into the base vehicle, such as lane departure systems and smart cruise control systems
        - Use Abstraction to simplify design

2) Give two examples from daily life for each of the eight ideas of computer architecture.

- Design for Moore's Law
    - Stocks during a bull market
    - IC/ Transistors doubling every two years
    - Automobiles moving toward clean energy/electric and then eventually water or hydrogen

- Use Abstraction to simplify design
    - High level languages that hide the detail of code needed to accomplish a task as it is compiled and then assembled into binary
    - OS hides the details involved in handling I/O devices

- Smart watch - sees time, heart rate, other details, not the how

- Make the common case fast
    - Using google maps instead of trying to figure it out manually
    - Saving your name, address, number, email and other personal data into Google's autofill feature for every job application you apply for.

- Performance via parallelism
    - instead of 1 CPU, you use multiple CPUs
    - Instead of 1 sales person being assigned a region, assign multiple salespeople to the same region

- Performance via pipelining
    - Any assembly factor, for food or products
    - Track sprint run where you have to pass the baton

- Performance via prediction
    - Gambling
    - Any venture capitalist ideas

- Hierarchy of memories
    - Any team based sports that run in parallel. If at an event, the person who is weakest at something goes first so the rest of the team can make up for them
    - Running errands. The store that is closest to you and where you only need one item happens first, Costco goes last.

- Dependability via redundancy
    - Tractor trailer with multiple tires
    - House with lots of support beams

3) 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.
    - High Level Language (C++, Python) ->(Compiles to) Assembly ->(Assembler to) Binary language
      Compilers translate the high level language into instructions that the hardware can execute
      Assemblers translates a version of instruction into binary that the computer understands and can execute directly

4) Give two examples of activities from daily life which can be performed in parallel.
    - Any form of multitasking : Cooking while reading the recipe
    - Listening to an audiobook while driving
    - Listening to music while doing anything else

5) Give two examples of activities from daily life which cannot be performed in parallel. Why these activities cannot be performed in parallel?

- Draw the number 6 while making clockwise circles with your leg while sitting at your desk
    - No idea why you can't do that but your brain won't let you
    - Learned that some people can actually condition yourself to not do this but general public cannot do this at the same time
- Chopping up carrots while jumping on a trampoline
    - Need a steady surface to cut carrots and jumping won't give you a steady surface. You need a place to put the multiple carrots and a surface to hold the cutting board. You're making a mess and won't actually be able to use the carrots. Could potentially cut off your finger.
- Driving a car and taking a shower
    - You are physically in two different places.

Create the text file using Microsoft Word, Open Office Writer, or a text editor. Name the document as follows:

FirstName_LastName_HW3

Rubric for Grading:

Description	Points
Question 1	10
Question 2	10
Question 3	10
Question 4	10
Question 5	10
Total Points	**50**