

# **CSC196: Great Ideas in Computing**

## **Tutorial 2**

**21st September 2022**

**Submit Assignment 1 on time, any doubts or problems submitting?**

# **Any issues with markdown notes for tutorial sessions?**

# Assignment1

- Due on October 7th 8AM, confirm on Markus
- 1 sign bit, 4 exponent bits, 3 significand bits
- The upper bit of the exponent bits denote sign of the exponent
  - We are not using bias here for representing negative exponents instead we are reserving one bit for sign
- How to represent 16 = 0 - 0 1 0 0 - 0 0 0
- How to represent 18 = 0 - 0 1 0 0 - 0 0 1
- What is the general formula?
  - $\pm 2^a * (1 + b/8)$
  - Where a is an integer in the range -7 to +7

# Fixed point vs floating point representation

- Every bit of precision will reduce the range by 2!
- Floating point has a concept of exponent which allows the decimal place to float around

# Von Neumann Architecture

- It is abstract for sequential computing
- Why is abstraction such a great idea?
  - Architect doesn't need to know what programming language will be run on the machine
  - A compiler writer for a language doesn't need to know what programs will be written using that
  - A programmer doesn't need to know architecture and compiler design to write programs

# Memory

- Memory is arranged in units of words, each word is addressable
- There is some cost associated with reading/writing each word
- Memory is arranged hierarchically
  - L1 cache on CPU
  - L2 cache on CPU
  - L3 cache on CPU
  - RAM
  - Page file on harddisk

# Memory Caching

- The higher we go on the hierarchy, the faster it is, but also it is more expensive
- Memory management system uses "locality of referenced", words closer spatially might be accessed together.
- When we need a word, we instead fetch a block of words (a.k.a page)
- Least Recently used (LRU) is a good caching mechanism
  - If cache is full and a new page needs to be loaded, delete the least recently used page
- Caching is sometimes also referred to as paging in this context
  - It is abstract for sequential computing



# Machine instructions

- Algorithms consist of series of instructions
- Each instruction can be stored in a word of memory
- Instructions are usually stored in fast memory

# Data flow architecture

- Not as popular as Von Neumann Architecture
- Businesses care about data and process is secondary to them
- These systems are non-deterministic
- The processing depends upon the input data and there is no instructions provided
- Think of Artificial Intelligence
- These might be relevant in specialized hardware used for signal processing, network routing and parallel architectures

# Multicore and Parallelism

- Nowadays CPUs have multiple cores which essentially handle multiple processes simultaneously
- Some challenges in Parallelism
- How many parallel processes to solve a problem? Should it be constant or change based on the amount of data?
- Synchronous vs Asynchronous processes
- Interprocess communication
- Data consistency, rebuild the original data from small parts without any corruption

# Dictionary data type, a.k.a Hash Table

- Unordered list of elements
- Each element is a key value pair
- Faster search as compared to a regular ordered list
  - How do you find your name cards?
    - For example, key can be the first alphabet of your name and value can be the ordered list of all card starting with that alphabet

# Wikipedia

- What is Wikipedia?
- Last thing you searched?
- Do you always trust it?
- Any examples of unrelialed information on Wikipedia?

# Announcements

- Next tutorial is 2 weeks after on 5th october
- If you have any questions, you can also ask on Piazza and I will answer them.