15-110 Recitation Week 9

Reminders

- HW4 Partial/Full Code Reviews are happening this weekend!
- Check 5 is due Monday, 3/28
- HW4 Partial/Full revision deadline is 3/29
- Quiz 4 is on Wednesday, 3/30
  - o Review session Sat, March 26th 2PM in NSH 3005

Overview

- Concurrency
- mapReduce
- Pipelining
- Quiz 3 Review
- Quiz 3 Resource Guide

Problems

CONCURRENCY:

Match the following examples to the corresponding level of concurrency.

Circuit-Level Concurrency

You have Zoom, Chrome, and Messages all open on your Mac at the same time. The scheduler decides Zoom gets the CPU at the current time being.

Multitasking

A computer calculates (4*5) // (2*2) in 2 time steps instead of 3

Multiprocessing

Everyone in 15-110 Lecture 1 is googling "Halloween parties near me" at the same time. Google routes these requests to different servers in one of their server farms.

Distributed Computing

Your computer has a processor chip with several cores. When you open Zoom, Google Chrome, and Pyzo at the same time the operating system assigns them to different cores.

Notes

Draw the concurrency tree for the following math equation:

(5 + 3) / (1 + 1) * (((36 / (10 - 4)) + (8 * 3)) − 9)

What is the number of **total steps**?

What is the number of **time steps**?

MAPREDUCE

Recall the components of a mapReduce algorithm.

Suppose we make a mapReduce function to count the number of files that have an even number of occurrences of the string "Trick or Treat!". Define the mapper, reducer, and manager actions.

Mapper:

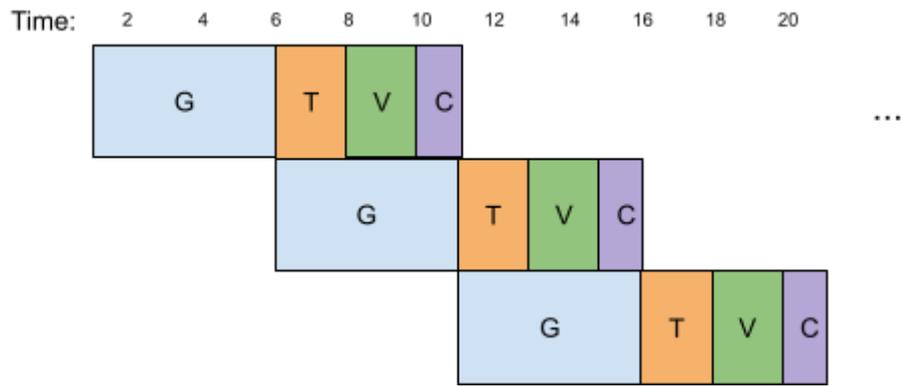Reducer:

Manager

PIPELINING

You just started your summer job working at the best burger restaurant in the United States, In-N-Out! It's the daily 1 hour lunch rush and you are trying to figure out what the most efficient way of churning out burgers is. Preparing the burgers for customers takes 4 steps that must be performed in this order: grilling burgers takes 5 minutes (G), toasting buns takes 2 minutes (T), placing vegetables takes 2 minutes (V), and dressing condiments takes 1 minute (C). You start off by just making the burgers one after another.

How many burgers can you fully complete in the 1 hour lunch rush? _____
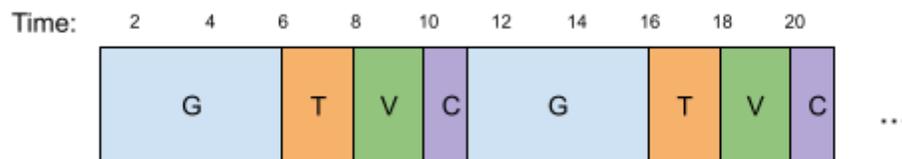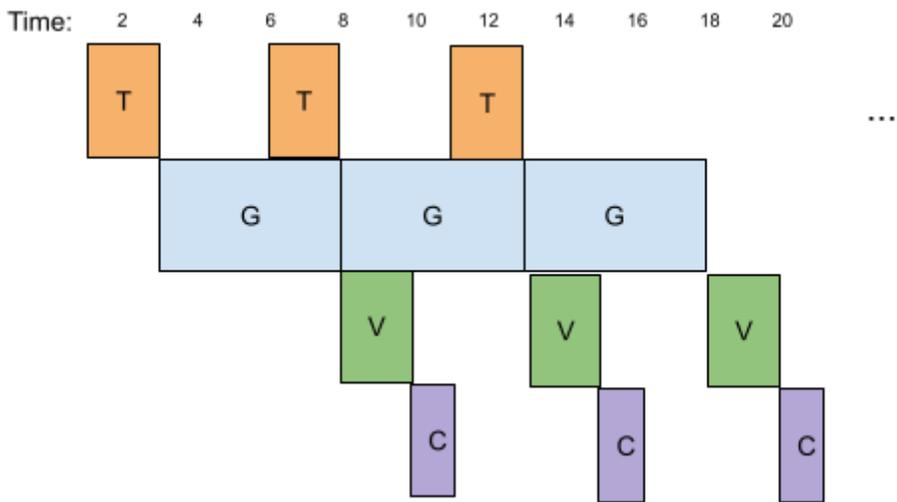

You and your friend just learned about pipelining in 15110 and your friend proposes the following pipelines to speed up burger production. Your friend asks you to check over the pipelines they made and see if there are any errors. For the following pipelines identify the error if there is one or say no error if there is none. (Assume you have as many workers and as much equipment as you need to build burgers)
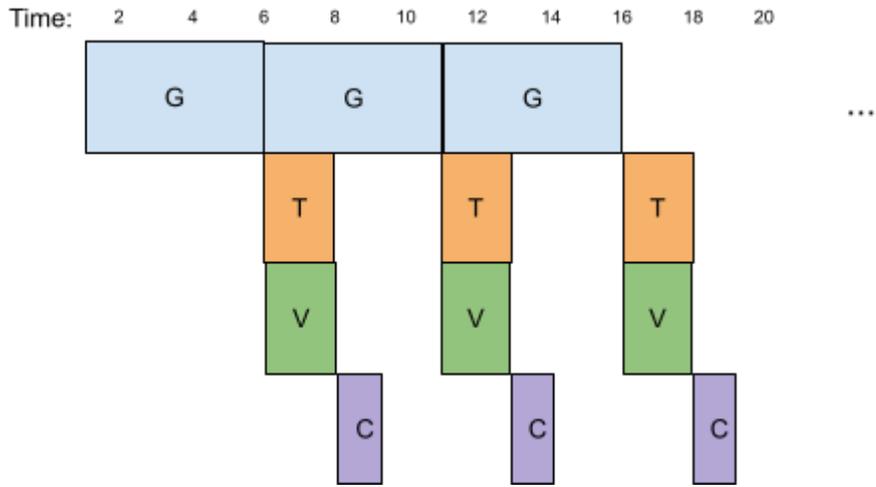
Option 1)

Option 2)

Option 3)

Time: 2 4 6 8 10 12 14 16 18 20

G	G	G

...

T   T   T

V   V   V

C   C   C

Option 4)

Time: 2 4 6 8 10 12 14 16 18 20

G	G	G

...

T   T   T
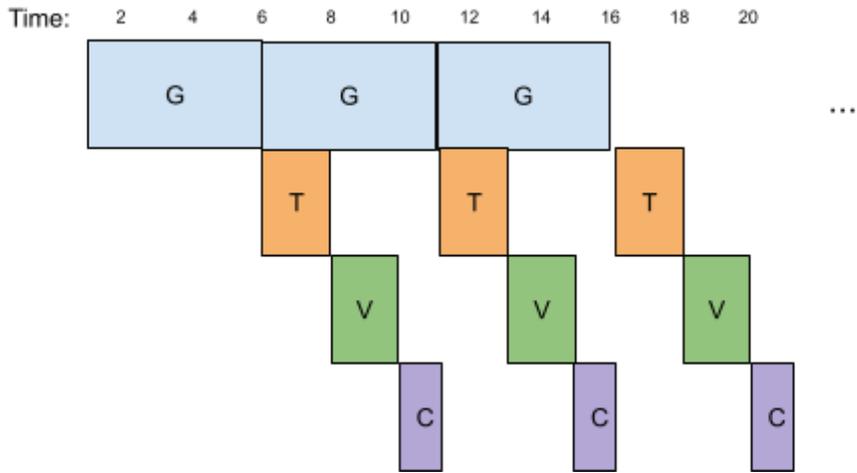
V   V   V

C   C   C

Using the correct pipelining strategy, how many burgers will you be able to make during the lunch rush?

With the correct pipelining strategy, how many workers do we need? With this number of workers, does pipelining allow for faster burger production? What are the tradeoffs?

Number of workers:

Additional answers/notes:

QUIZ 3 REVIEW

Topics:
- Recursion
- Dictionaries
- Hashing
- Aliasing

Recursion

Write the recursive function sumDivisors(L, k) that returns the sum of all numbers in the list that are divisible by k. For example, sumDivisors([1,2,3,4,5], 2) should return 2 + 4 => 6

Dictionaries
Quick questions
How do you add a key value pair to the dictionary: _____

How do you check if something is in a dictionary: _____

How do you loop over a dictionary d: _____

What would be printed after these lines of code

```
d = {"a":5, 10:10, "c":15, "hello":22}
for k in d:
    if type(d[k]) == int:
        print(k)
```

Hashing

Aliasing

What will each of these variables be assigned to after we run this block of code?

```
A = [1,2,3]

B = A[1:]
C = A

B.append(A[0]*2)
C.extend( [4,5,6] )
C += [7]
A.pop(0)
C.pop(0)

print(A,B,C)
```
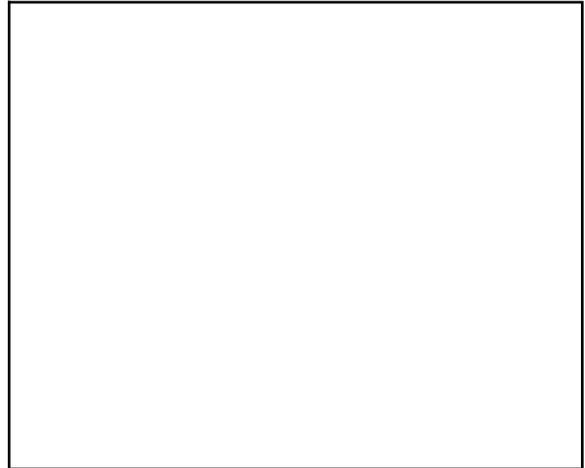
Quiz 3 Resource Guide: week 5-6 Materials

Aliasing Lectures:

Lecture: References and Memory(02/14)

Slides:

https://www.cs.cmu.edu/~15110/slides/week5-1-references.pdf

Recording:

https://canvas.cmu.edu/courses/27271/pages/lecture-5-1-references-and-memory

Practice:

Ex5-1

https://www.cs.cmu.edu/~15110/practice/week4-practice-lists.pdf

Recursion Lectures:

Lecture: Recursion (2/16)

Lecture: Recursion II & Search Algorithms (02/18)

Slides:

https://www.cs.cmu.edu/~15110/slides/week5-2-recursion.pdf

https://www.cs.cmu.edu/~15110/slides/week5-3-search.pdf

Recordings:

https://canvas.cmu.edu/courses/27271/pages/lecture-5-2-recursion

https://canvas.cmu.edu/courses/27271/pages/lecture-5-3-recursion-ii-and-search-algorithms

Practice:

Ex5-1 and Ex5-2

https://www.cs.cmu.edu/~15110/practice/week5-practice-recursion.pdf

https://www.cs.cmu.edu/~15110/practice/week5-practice-search.pdf

Dictionaries Lecture:

Lecture: Dictionaries (02/21)

Slides:

https://www.cs.cmu.edu/~15110/slides/week6-1-dictionaries.pdf

Recording:

https://canvas.cmu.edu/courses/27271/pages/lecture-6-1-dictionaries

Practice:

Ex6-1

https://www.cs.cmu.edu/~15110/practice/week6-practice-dictionaries.pdf

Hashing Lecture:

Quiz2 & Activity: Designing Super-Fast Search (02/23)

Slides:

https://www.cs.cmu.edu/~15110/slides/week6-2-hashing.pdf

Recording:

https://canvas.cmu.edu/courses/27271/pages/lecture-6-2-designing-super-efficient-search

Practice:

Ex6-2

https://www.cs.cmu.edu/~15110/practice/week6-practice-dictionaries.pdf

Search Algorithms Lecture:

Lecture: Recursion II & Search Algorithms (02/18)

Slides:

https://www.cs.cmu.edu/~15110/slides/week5-3-search.pdf

Recording:

https://canvas.cmu.edu/courses/27271/pages/lecture-5-3-recursion-ii-and-search-algorithms

Practice:

Ex5-3

https://www.cs.cmu.edu/~15110/practice/week5-practice-search.pdf

Big-O Notation Lecture:

Lecture: Runtime and Big-O Notation (02/25)

Slides:

https://www.cs.cmu.edu/~15110/slides/week6-3-big-o.pdf

Recording:

https://canvas.cmu.edu/courses/27271/pages/lecture-6-3-big-o-runtime

Practice:

Ex6-3

https://www.cs.cmu.edu/~15110/practice/week6-practice-bigo.pdf

Quiz 3

- Solutions to Quiz 3, look at Piazza for more info this weekend
- Review video for Quiz 3 topics, look at Piazza for more info this weeknd
- Wed lecture where we talk abt Quiz 3
  - https://www.cs.cmu.edu/~15110/slides/week9-1-parallel.pdf
- Link here Piazza post with strategies for learning from Quiz 3
  - https://piazza.com/class/ky1wxr8yjxn3do?cid=247
- Quiz 3 materials: https://www.cs.cmu.edu/~15110/assessments.html#quiz3