15-110 F25 Check5 - Written Portion

Name:

AndrewID:

Complete the following problems in the fillable PDF, or print out the PDF, write your answers by hand, and scan the results. When you are finished, upload your check5.pdf to **Check5 - Written** on Gradescope.

Written Problems

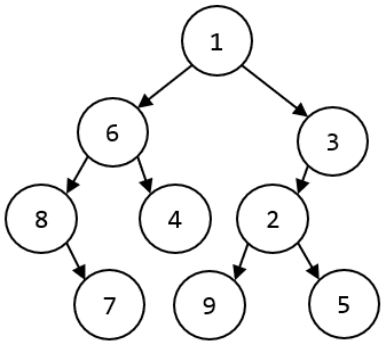
#1 - Total Steps vs Time Steps - 20pts

Can attempt after Parallel Programming lecture

You decide to implement linear tree search using concurrency in order to increase its efficiency without needing to 'sort' the tree. You do this with the following algorithm:

1. Base case: if the root's value matches the sought item, return `True`
2. Base case: if the root has no children and does not match, return `False`
3. Recursively call linear search on the left child of the tree, if it exists
4. **Concurrent with step 3**, recursively call linear search on the right child of the tree, if it exists
5. Combine the recursive results of steps 3 and 4 together with an `or` operation and return the result

If this algorithm runs on the tree below and the item **10**, counting each recursive call as a single step, how many **total steps** and how many **time steps** will occur?



Total Steps:	
Time Steps:	

#2 - Pipelining - 30pts

Can attempt after Parallel Programming lecture

You are managing a volunteer organization that makes peanut butter and jelly sandwiches. The steps to make a PB&J sandwich are:

1. [P] Spread peanut butter on one slice of bread (30 seconds)
2. [J] Spread jelly on top of the peanut butter (30 seconds)
3. [S] Complete the sandwich by putting a slice of bread on top (15 seconds)

Originally each worker makes one sandwich at a time, with all three workers working in parallel. Each of the cells in the following table represents 15 seconds, with the whole table representing three minutes of work. Fill in the cells with the letters representing the steps to demonstrate the original system the volunteers used.

Logistical note: If a step spreads across multiple cells, designate this with a dash (-) in the cell(s) following the first one. If no work occurs in a cell, leave it blank.

Worker	00:00	00:15	00:30	00:45	01:00	01:15	01:30	01:45	02:00	02:15	02:30	02:45
A												
B												
C												

How many complete sandwiches could be made by three workers in three minutes with the original system?	

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Recent changes have affected the ingredients you have to work with; now you just have one giant tub of peanut butter and one giant tub of jelly. You decide to reorganize the workers to accommodate the changes while still being efficient. Create a new schedule that uses **pipelining** to make sandwiches instead.

Worker	00:00	00:15	00:30	00:45	01:00	01:15	01:30	01:45	02:00	02:15	02:30	02:45
A												
B												
C												

How many complete sandwiches could be made by three workers in three minutes with the new pipeline?	

#3 - Concurrency - 15pts

Can attempt after Distributed Computing and the Internet lecture

We described three general approaches for implementing concurrency in lecture (multitasking, multiprocessing, and distributed computing). These approaches can be applied to real life as well (with questionable results). Map each of the following scenarios to the concurrency approach that **best** matches it.

While completing three separate homework assignments you rapidly switch from one assignment to another, swapping tasks whenever you find yourself getting stuck.	
While working on a large group project you and three friends split up the tasks, each work on a set of subtasks separately, then combine your results at the end.	
While filling in data for a lengthy lab report you use a pencil in each hand to write in data points in two separate columns simultaneously.	

#4 - Internet Communication Process - 5pts

Can attempt after Distributed Computing and the Internet lecture

How is a website sent across the internet to your web browser? **Select one answer.**

- ☐ The server creates a packet of the whole website and sends it as fast as possible to your browser
- ☐ The server zips up the website to make it as small as possible so none of the data gets lost
- ☐ The server splits the website into packets and makes sure they all get there in the right order
- ☐ The server creates packets out of the website and sends them all to your computer, which puts them together in the right order

#5 - Encryption - 30pts

Can attempt after Fault Tolerance and Security lecture

Isaac wants to send an encrypted message to Nora using a shared key. An adversary, Terry, wants to read the message without Isaac or Nora's permission or the key.

The following steps describe how the message is encrypted and transmitted, but the steps have been jumbled out of order and the names are missing. Order the steps by writing numbers in the spaces to the left (1 for the first step, 2 for the second, etc), then write the name that should fill in the blank for each statement (Isaac, Nora, or Terry).

#	Name	Step
		____ sends the message through the internet.
		____ receives the message.
		____ intercepts and tries to read the message, but cannot because they don't have the key.
		____ uses the key to decode the message, creating the plaintext.
		____ uses the key to encode the message, creating the ciphertext.
		____ reads the message.