SYSTEMS EXAM
Fall 2022
90 minutes

Choose only two problems on the exam to solve. Check the boxes below for the problems for which you are submitting answers.

#1
#2
#3

How many answer pages total?_____

Do not write on the test sheet or on the back of your answer pages.

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(Print full Name)

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(signature)

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(NetId)

1. (20pts Total) CPU Scheduling

a) (4pts) What are the 5

3) (20 pts Total) Process Synchronization

a) (4pts) Compare and contrast the following two (2) methods for solving the synchronization problem: Atomic Instruction and Mutex Lock. Specify how each of these work in words. (Do not write code).

b) (4pts) Under what conditions does a race condition occur, and why should it be avoided?

c) (4pts) Consider the incorrect solution below to the   ining P   problem below. There are 5 philosophers. Philosopher i where (i = 0, 1, 2, 3, 4). There are five (5) semaphores fork(i) which are all initialized to 1. Show a sequence of events where deadlock can occur.

```
while (true){
        think;
        wait(mutex);
        wait fork[i];
        signal(mutex);
        wait(mutex);
        wait fork[(i+1) %5];
        signal(mutex);
            eat;
        signal(fork[i]);
        signal(fork[(i + 1) %5];
}
```

d) (4pts) How would you fix the code above so that deadlock does not occur?

e) (4pts) Assuming a correct implementation of the Dining Ph