

# CS 354 Fall 2025

## Homework 1 [20 pts]

**Due: 9/19/2025 (Fri.), 11:59 PM**

1. Suppose someone tells you that a Xinu system has three processes as follows:

name	priority	state
main	20	READY
X	19	CURRENT
Y	30	READY

Could the information be correct? Why or why not?

2. Suppose Xinu system has six processes as follows:

name	priority	state
main	20	READY
A	30	CURRENT
B	22	READY
C	20	WAITING
D	24	READY
E	20	SUSPENDED

(a) What will the ready list contain? (Indicate the head and tail of the list.)

(b) After a timeslice event occurs, which process will be running? Explain.

3. Suppose Xinu system has six processes as follows:

name	priority	state
A	20	CURRENT
B	20	READY
C	20	WAITING
D	20	SUSPENDED
E	20	SUSPENDED

If a timeslice event occurs, which processes, if any, will change state, what will the new states be, and what will the ready list contain?

4. Suppose Xinu system has six processes as follows:

name	priority	state
A	20	CURRENT
B	20	READY
C	20	WAITING
D	20	SUSPENDED
E	20	SUSPENDED

If process A calls `resume` on process C, which processes, if any, will change state, what will the new states be, and what will the ready list contain? Explain.

5. Suppose Xinu system has five processes as follows:

name	priority	state
A	20	CURRENT
B	20	READY
C	20	WAITING
D	20	SUSPENDED
E	20	SUSPENDED

If process A calls `resume` on process E, which processes, if any, will change state, what will the new states be, and what will the ready list contain? Explain.

6. Suppose Xinu system has five processes as follows:

name	priority	state
A	20	CURRENT
B	20	READY
C	20	WAITING (semaphore = 13)
D	20	SUSPENDED
E	20	SUSPENDED

If process A signals semaphore 13, which processes, if any, will change state, what will the new states be, and what will the ready list contain?

7. Suppose Xinu system has five processes as follows:

name	priority	state
A	20	CURRENT
B	20	READY
C	20	WAITING (semaphore = 13)
D	20	SUSPENDED
E	20	SUSPENDED

(a) Suppose process A creates and resumes a new process, F, that has priority 21. Which processes, if any, will change state, what will the new states be, and what will the ready list contain?

(b) Suppose that when process F runs, it resumes D, then resumes E, and then signals semaphore 13. Finally F exits. What will the states of the processes be, and what will the ready list contain?

8. A scientist uses Xinu to create and resume 100 processes with priority 10. After all 100 processes have been resumed, the main process exits, and there are no other processes running. Each of the processes starts with an input value, performs a complex computation that requires several seconds of computation, and then uses `kprintf` to print a single floating point value. After printing its value the process exits.

Let's refer to the processes as P1 through P100, and assume they are created and resumed in order from 1 to 100.

(a) After all 100 processes have been resumed and just before the main process exits, will the ready list have the most recently created process at the head (i.e., will the ready list contain P100, P99, P98, and so on)? Explain.

(b) Will the 100 output values be in random order or will they be ordered by the processes? That is, will the processes finish randomly or will they have definite order, such as P1, P2, P3... or perhaps P100, P99, P98,...?

9. You have been asked to debug someone's implementation of wait and signal. You insert `kprintf` statements to dump the semaphore table.

(a) You find that the semaphore with ID 3 has a count of 4 instead of 3. Does that indicate an error in the code? Explain why or why not.

(b) You find that the semaphore with ID 17 has a count of -7. What must be present on the list of waiting processes if the implementation is correct? Explain.

(c) You find that the semaphore with ID 2 has a count of 12, but only has 11 processes on the list of waiting processes. Does that indicate an error in the code? Explain why or why not.

10. The Xinu code returns `YSERR` if someone attempts to create a semaphore with an initial value of -1. Explain why that check is in the code.

11. The Xinu implementation of `suspend` does not place a suspended process on any list. Imagine changing the `suspend` code to place a suspended process on a list of all suspended processes. Also imagine changing the code in `resume` to search the list of suspended processes to determine whether the argument specified a process that was indeed suspended. Would such an implementation run faster than the current implementation? Explain.

12. Suppose that someone calls

```
create(fun1, 4096, 99, "newpr", 2, 3, 4)
```

(a) How large will the stack of the new process be?

(b) Where will the process begin executing?

(c) How many arguments will be passed to the top-level function?

## Submission

You must submit a directory named `hw1` that contains a PDF file (created using dedicated PDF creator or converter):

- `questions.pdf`, containing your answers.

Go to the directory where `hw1` is a subdirectory.

For example, if `/homes/alice/cs354/hw1` is your directory structure, go to `/homes/alice/hw1`.

Type the following command to submit the directory with `turnin`:

```
turnin -c cs354 -p hw1 hw1
```

Be sure the file inside the directory is named exactly `questions.pdf`.

You can check/list the submitted files using

```
turnin -c cs354 -p hw1 -v
```