2023 Midterm Exam

Single Choice Questions

1. Policy ______.

- ☐ A) determines how to do something
- ☑ B) determines what will be done
- ☐ C) is not likely to change across places
- ☐ D) is not likely to change over time

2. A microkernel is a kernel ______.

- ☐ A) containing many components that are optimized to reduce resident memory size
- ☐ B) that is compressed before loading in order to reduce its resident memory size
- ☐ C) that is compiled to produce the smallest size possible when stored to disk
- ☑ D) that is stripped of all nonessential components

3. ______ provide(s) an interface to the services provided by an operating system.

- ☐ A) Shared memory
- ☑ B) System calls
- ☐ C) Simulators
- ☐ D) Communication

4. Mechanism ______.

- ☑ A) determines how to do something
- ☐ B) determines what will be done
- ☐ C) is not likely to change across places
- ☐ D) is not likely to change over time

5. Assume that preemptive scheduling is adopted. What is the average waiting time for these processes with the SJF scheduling algorithm?

Process	Arrival Time	Burst Time
P1	0	8
P2	2	4
P3	4	2

- ☐ A) 4
- ☐ B) 5
- ☑ C) 8/3
- ☐ D) 11/3

6. According to the following program with `fork()` system call, explain what output will be at Line A. (Suppose all `fork()` system calls are succeed.)

```
#include <sys/types.h>
#include <sts/wait.h>
#include <stdio.h>
#include <unistd.h>


int main() {
    int value = 5;
    pid_t pid;
    pid = fork();
    value += 10;
    pid = fork();
    value += 10;

    if (pid == 0) {
        value += 15;
        return 0;
    } else if (pid > 0) {
        wait(NULL);
        printf("%d\n", value);  /* LINE A */
        return 0;
    }
}
```

- □ A) 5
- □ B) 15
- ☑ C) 25
- □ D) 40

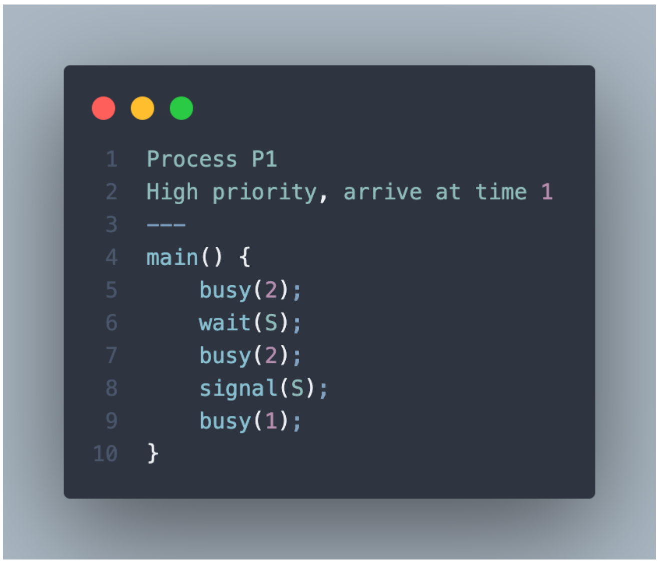
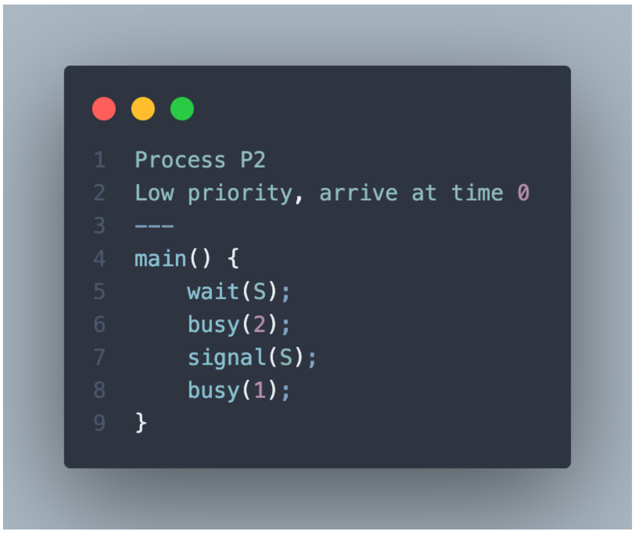
7. Which one of the following is an incorrect transition of process states?

- □ A) running -> waiting
- ☑ B) waiting -> running
- □ C) ready -> running
- □ D) waiting -> ready

8. Which is not the main advantage of multiprocessor systems?

- □ A) Increased throughput
- □ B) Economy of scale
- □ C) Increased reliability
- ☑ D) high CPU utilization

9. The CPU busy for x units of time. Now let P1 and P2 arrive at the system at time 1 and 0, respectively. S is a semaphore whose initial value is 1. Let the CPU scheduler be preemptive and priority-driven, and the priority of p1 is higher than that of p2.

Process P1 High priority, arrive at time 1	Process P2 Low priority, arrive at time 0
	

```
Process P1
High priority, arrive at time 1
---
main() {
    busy(2);
    wait(S);
    busy(2);
    signal(S);
    busy(1);
}
```

```
Process P2
Low priority, arrive at time 0
---
main() {
    wait(S);
    busy(2);
    signal(S);
    busy(1);
}
```

Ignore the time overhead of semaphore operations and context switches. What the turnaround time of the two processes?

- ☐ A) Turnaround time P1 is 5 and P2 is 8
- ☑ B) Turnaround time P1 is 6 and P2 is 8
- ☐ C) Turnaround time P1 is 7 and P2 is 9
- ☐ D) Turnaround time P1 is 6 and P2 is 9

10. How many processes including the original process will the following C programs with the Unix system call `fork()` create? Suppose all `fork()` system calls are succeed.

~~~
int main() {
    int i;
    for (i = 0; i < 3; i++) {
        if (fork() == 0) {
            fork();
            fork();
            fork();
        }
    }
}

- [ ] A) 128
- [ ] B) 637
- [x] C) 729
- [ ] D) 7414

### 11. What would be the output of the following C program that uses the
Pthreads API?

```c
#include <stdio.h>
#include <stdlib.h>
#include <unistd.h>
~~~

```c
#include <pthread.h>
#include <sys/types.h>
#include <sys/wait.h>

static void *runner(void *param) {
    (*(int*)param)--;
    pthread_exit(0);
}

int main(int argc, char **argv) {
    int value = 11;
    pid_t pid = fork();
    if (pid > 0) {
        int status;
        waitpid(-1, &status, 0);
        printf("A=%d\n", value--);
    } else if (pid == 0) {
        pid_t pid = fork();
        if (pid > 0) {

        }
    }













            else {
                printf("D=%d\n", ++value);
            }
        } else {
            return 1;
        }
    } else {
        return 1;
    }
    return 0;
}
```

- ☑ A) A=11, B=10, C=10, D=11
- □ B) A=13, B=11, C=11, D=13
- □ C) A=9, B=10, C=11, D=12
- □ D) A=9, B=11, C=13, D=9

12. Which of the following was not given as a necessary condition for a deadlock to occur?

- ☑ A) Avoidance
- □ B) Hold and Wait

- ☐ C) Mutual Exclusion
- ☐ D) Circular wait

13. Deadlocks can be prevented only if ______.

- ☐ A) all four necessary conditions cannot hold.
- ☑ B) at least one of the four necessary condition cannot hold.
- ☐ C) at least one of the four necessary ondition cannot hold.
- ☐ D) circular wait condition cannot hold.

14. Which of the following statements is trye regarding the Interprocess Communication?

- ☑ A) Shared memory is typically faster than message passing.
- ☐ B) Message passing is most useful for exchanging large amounts of data.
- ☐ C) Message passing is typically faster than shared memory.
- ☐ D) Shared memory is far more common in operating systems than message passing.

15. A race condition ______.

- ☐ A) results when several threads try to access the same data concurrently
- ☑ B) results when several threads try to access the modify the same data concurrently
- ☐ C) will result only if the outcome of execution does not depend on the order in which instruction are executed.
- ☐ D) None of the above

16. COnsider a system with five processes P0 ~ P4 and four resource type, A, B, C, and D. Suppose at time T0, the reource allocation state is:

```
|    |   Allocation   | |       Max       | |   Available   |
|    | A | B | C | D | | A | B | C | D | | A | B | C | D |
| P0 | 2 | 1 | 1 | 0 | | 3 | 1 | 3 | 3 | | 1 | 1 | 2 | 0 |
| P1 | 0 | 1 | 1 | 2 | | 3 | 2 | 1 | 2 | |               |
| P2 | 1 | 0 | 0 | 3 | | 1 | 0 | 4 | 3 | |               |
| P3 | 0 | 1 | 2 | 0 | | 2 | 1 | 2 | 0 | |               |
| P4 | 1 | 0 | 0 | 2 | | 1 | 1 | 0 | 2 | |               |
```

- ☑ A) `<P4,P3,P2,P0,P1>` is a safe sequence.
- ☐ B) `<P4,P3,P1,P0,P2>` is a safe sequence.
- ☐ C) `<P2,P1,P0,P3,P4>` is a safe sequence.
- ☐ D) `<P3,P4,P2,P1,P0>` is a safe sequence.

17. The following code fragments decsribe a solution of the bounded-buffer problem. The three variables S1, S2, S3 are all semaphores. Suppose that the buffer initially has 10 empty slot. What are the correct initial values of the semaphores?

```
Producer processes:
    do {
        // produce an item
        wait(S2);
        wait(S1);
        // add the item to the buffer
        signal(S1);
        signal(S3);
    } while (true);
```

```
Consumer processes:

    do {
        // remove an item from buffer
        wait(S3);
        wait(S1);
        // consumer the removed item
        signal(S1);
        signal(S3);
    } while (true);
```

- ☐ A) S1=1, S2=1, S3=1
- ☐ B) S1=1, S2=0, S3=0
- ☑ C) S1=1, S2=10, S3=0
- ☐ D) S1=0, S2=10, S3=10

Multiple Choice Questions

1. Which events can cause a trap (or software interrupt)?

- ☑ A) Division by zero
- ☐ B) I/) completion
- ☐ C) clock interrupt
- ☑ D) System call

2. Which are privileged instructions?

- ☑ A) I/O instructions
- ☐ B) trap or software - generated interrupt
- ☐ C) WAIT instruction
- ☑ D) the base and limit registers (for memory space) loading

3. Which scheduling criteria can be used to compare CPU-scheduling algorithms?

- ☑ A) waiting time
- ☑ B) turnaround time
- ☐ C) I/O access time
- ☑ D) response time

4. Which of the following scheduling algorithms could result in starvation?

- ☐ A) First-come, first-served
- ☐ B) Round-robin
- ☑ C) Shortest job first
- ☑ D) Priority

5. CPU scheduling decistions may take place when a process:

- ☑ A) switches from running to waiting state
- ☑ B) Switches from the waiting state to the ready state
- ☐ C) Switches from the ready state to the running state
- ☐ D) Switches from the running state to the decision state