

Name: ..SAMPLE SOLUTIONS.....

Problem 1. (50 POINTS)

TYPE A

1. **TRUE** A primary objective of an OS is to manage hardware resources and provide services to users.
2. **FALSE**. Two different processes in Linux can have the same PID (process ID).
3. **FALSE**. Process management code in the kernel is always executed in user-mode.
4. **FALSE**. A (single) fork() in Linux can create two processes.
5. **FALSE**. Context switching in multi-tasking (eg CTSS) is as expensive as context switching in multi-programming.
6. **FALSE**. A user-mode process can modify the PCB of its own process.
7. **FALSE**. It is possible for a process to have its state changed from SUSPEND directly into RUNNING.
8. **TRUE** The best way to exploit temporal locality is to store recently used instructions or data in the cache.
9. **TRUE** I/O instructions in a user-program are executed in kernel-mode.
10. **FALSE**. System calls in a user-program are executed in user-mode.

Problem 2. (50 POINTS)

TYPE A

1. **Program in execution**
2. **Harvard**
3. **Child's PID**
4. **Temporal, Spatial**
5. **Speeds up/ Increases effective memory access**
6. **Security/Safety issues; users can't interfere with kernel**
7. **Former: Process in HDD (swapped out), Latter: Process still in MM**
8. **PID, PPID, return-value-of-fork**
9. **256KiB**

Problem 3. (50 POINTS)

TYPE A

- (3.1) A (associativity) = 20
- (3.2) C (line size) = 16384
- (3.3) K (block size) = 64B
- (3.4) C num of bit = 14
- (3.5) K num of bit = 6
- (3.6) T num of bit (tag)= 28

Problem 4. (30 POINTS)

TYPE A. $200\% \times 10 = 10 \times H + (1 - H) \times (10 + 100)$ thus $H = 90\%$ or equivalently $H = 0.9$.

Problem 5. (30 POINTS)

TYPE A. fval is 0 for a child and greater than zero for a parent. Code of if will be executed by the parent and fval is the PID of the child i.e. 4567. (note fval is > 1000 thus body of if will be executed).

Problem 6. (30 POINTS)

Let FHDD stand for Failed HDD. In a period of one CS332 year Number of FHDD/y is equal to total hours of operation in a year of all HDD divided by MTTF i.e.

TYPE A. We have 1,440,000hrs/FHDD.

$$\frac{24hr/d \times 30d/mo \times 12mo/y \times 1000}{1,440,000hr/FHDD} = 6FHDD/y$$

Problem 7. (30 POINTS)

(a) TYPE A
 A is 20min CPU and 40min I/O Total=60min
 B is 40min I/O and 20min CPU Total=60min
 Schedule: A B
 El(A) = 60min El(B)=120min
 CPUUtil = 40/120 = 1/3 or 33%

(b) TYPE A
 20 20 20 20
 Schedule: CPU A B
 I/O B B A A
 El(A) = 80min El(B)=60min
 CPUUtil = 40/80 = 1/2 or 50%

(c) TYPE A
 10s slice
 SSSSSSSSSSSS
 Schedule: CPU A A B B
 I/O B BABABA A
 El(A) =110min El(B)=120min
 CPUUtil = 40/120 = 1/3 or 33%