Philadelphia University Faculty of Engineering Department of Computer Engineering		Date:- 17/06/2015 Allowed time:- 2 hours

Operating Systems (630422) Final Exam

Student Name: - ……..... ID: - ……

Question 1: Chose the correct answer of the followings.

1. In a(n) ____ temporary queue, the sender must always block until the recipient receives the message.
   a) zero capacity b) variable capacity c) bounded capacity d) unbounded capacity

2. Which of the following is true of earliest-deadline-first (EDF) scheduling algorithm?
   A) When a process becomes runnable, it must announce its deadline requirements to the system.
   B) Deadlines are assigned as following: the earlier the deadline, the lower the priority; the later the deadline, the higher the priority.
   C) Priorities are fixed; that is, they cannot be adjusted when a new process starts running.
   D) It assigns priorities statically according to deadline.

3. A race condition ____.
   A) results when several threads try to access the same data concurrently
   B) results when several threads try to access and modify the same data concurrently
   C) will result only if the outcome of execution does not depend on the order in which instructions are executed
   D) None of the above

4. A cycle in a resource-allocation graph is ____.
   A) a necessary and sufficient condition for deadlock in the case that each resource has more than one instance
   B) a necessary and sufficient condition for a deadlock in the case that each resource has exactly one instance
   C) a sufficient condition for a deadlock in the case that each resource has more than once instance
   D) is neither necessary nor sufficient for indicating deadlock in the case that each resource has exactly one instance

5. Assume there are three resources, R_1, R_2, and R_3, that are each assigned unique integer values 15, 10, and 25, respectively. What is a resource ordering which prevents a circular wait?
   A) R_1, R_2, R_3 B) R_3, R_2, R_1 C) R_3, R_1, R_2 D) R_2, R_1, R_3

6. Consider a logical address with a page size of 8 KB. How many bits must be used to represent the page offset in the logical address?
   A) 10 B)8 C)13 D) 12

7. Consider a 32-bit address for a two-level paging system with an 8 KB page size. The outer page table has 1024 entries. How many bits are used to represent the second-level page table?
   A) 10 B) 8 C) 12 D) 9

8. _____ allows the parent and child processes to initially share the same pages, but when either process modifies a page, a copy of the shared page is created.
   A) copy-on-write B)zero-fill-on-demand
   C) memory-mapped D) virtual memory fork

9. _____ occurs when a process spends more time paging than executing.
   A) Thrashing B)Memory-mapping C) Demand paging D) Swapping

10. A _____ is used on UNIX systems at the beginning of some files to roughly indicate the type of the file.
    A) file extension B) creator name C) hint D) magic number

Question2:Explain the difference between an I/O-bound process and a CPU-bound process. 2 points

Ans: The differences between the two types of processes stem from the number of I/O requests that the process generates. An I/O-bound process spends more of its time seeking I/O operations than doing computational work. The CPU-bound process infrequently requests I/O operations and spends more of its time performing computational work.

Question3:Describe how UNIX and Linux manage orphan processes. 2 points

Ans: If a parent terminates without first calling wait(), its children are considered orphan processes. Linux and UNIX assign the init process as the new parent of orphan processes and init periodically calls wait() which allows any resources allocated to terminated processes to be reclaimed by the operating system.

Question4:What are the three general ways that a deadlock can be handled? 3 points

Ans:

1- A deadlock can be prevented by using protocols to ensure that a deadlock will never occur.
2- A system may allow a deadlock to occur, detect it, and recover from it.
3- operating system may just ignore the problem and pretend that deadlocks can never occur.

Question 5:Consider the following snapshot of a system: 4 points

	Allocation	**Max**	**Available**
	A B C D	*A B C D*	*A B C D*
P0	2 0 0 1	4 2 1 2	3 3 2 1
P1	3 1 2 1	5 2 5 2	
P2	2 1 0 3	2 3 1 6	
P3	1 3 1 2	1 4 2 4	
P4	1 4 3 2	3 6 6 5	

If a request from process *P*1 arrives for (1, 1, 0, 0), can the request be granted immediately?
Allocate p1 the required resources

	Allocation	**Max**	**Available**
	A B C D	*A B C D*	*A B C D*
P0	2 0 0 1	4 2 1 2	2 2 2 1
P1	4 2 2 1	5 2 5 2	
P2	2 1 0 3	2 3 1 6	
P3	1 3 1 2	1 4 2 4	
P4	1 4 3 2	3 6 6 5	

Apply banker algorithm on the matrix

	NEED	**work**
	A B C D	2 2 2 1
P0	2 2 1 1	
P1	1 0 3 1	
P2	0 2 1 3	
P3	0 1 1 2	
P4	2 2 3 3	

1- process P0 can be served then marked as finished and work become 4 2 2 1
2- process P1 can be served then marked as finished and work become 8 4 4 2
3- process P2 can be served then marked as finished and work become 10 5 4 3
4- process P3 can be served then marked as finished and work become 11 8 5 5
5- process P4 can be served then marked as finished and work become 12 12 8 7

It is safe to allocate p1 (1,1,0,0) so the request canbe granted immediately.

Question 6:How is a limit register used for protecting main memory? 2 points

Ans: When the CPU is executing a process, it generates a logical memory address that is added to a relocation register in order to arrive at the physical memory address actually used by main memory. A limit register holds the maximum logical address that the CPU should be able to access. If any logical address is greater than or equal to the value in the limit register, then the logical address is a dangerous address and an error results.

Question 7:Explain how enhanced second chance algorithm is works. 4 points

The algorithm define reference bit and the modify bit (described in Section 9.4.1) as an ordered pair. With these two bits, we have the following four possible classes:

1. (0, 0) neither recently used nor modified—best page to replace

2. (0, 1) not recently used but modified—not quite as good, because the page will need to be written out before

3. (1, 0) recently used but clean—probably will be used again soon

4. (1, 1) recently used and modified—probablywill be used again soon, and the page will be need to be written out to disk before it can be replaced

Question 8:Consider the following page reference string: 1, 2, 3, 4, 2, 1, 5, 6, 2, 1, 2, 3, 7, 6, 3, 2, 1, 2, 3, 6. How many page faults would occur for the following replacement algorithms, Remember that all frames are initially empty. 6 points

• LRU replacement

1	1	1	4	4	4	5	5	5	1	1	1	1	7	7	7	2	2	2	2
	2	2	2	2	2	2	6	6	6	6	6	3	3	3	3	3	3	3	3
		3	3	3	1	1	1	2	2	2	2	2	2	6	6	6	1	1	6
PF	PF	PF	PF		PF	PF	PF	PF	PF			PF	PF	PF		PF	PF		PF

Number of page fault = 15

• FIFO replacement

1	1	1	4	4	4	4	6	6	6	6	3	3	3	3	2	2	2	2	6
	2	2	2	2	1	1	1	2	2	2	2	7	7	7	7	1	1	1	1
		3	3	3	3	5	5	5	1	1	1	1	6	6	6	6	6	3	3
PF	PF	PF	PF		PF	PF	PF	PF	PF		PF	PF	PF		PF	PF		PF	PF

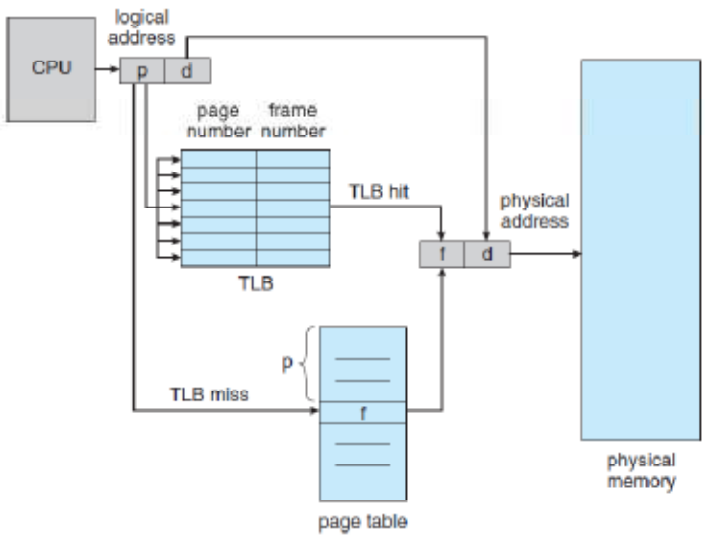
Number of page fault = 16

• Optimal replacement

1	1	1	1	1	1	1	1	1	1	1	3	3	3	3	3	3	3	3	6
	2	2	2	2	2	2	2	2	2	2	2	7	7	7	2	2	2	2	2
		3	4	4	4	5	6	6	6	6	6	6	6	6	6	1	1	1	1
PF	PF	PF	PF			PF	PF				PF	PF			PF	PF			PF

Number of page fault = 11

Question 9:Describe the address translation process, show how TLB can be used with page table to fine the physical address from the logical address. 3 points



Question 10:How files can be protected from race condition when multiple access occur. 2 points

Ans:
By using shared lock (which is a read lock) and exclusive Lock (which is write lock)
No update to the file while shared lock is acquired by a process or more and no read or write on the file while the exclusive lock is acquired by any process

Question 11:Given the following code write a code for test_and_set function bellow 2 points

```
do {
while (test_and_set(&lock));

/* critical section */

lock = false;

} while (true);
```

Ans.

```
boolean test and set(boolean *target) {
boolean rv = *target;
*target = true;
return rv;
}
```