number of page faults the appli
algorithms. Assume that all pages
Reference Stream: E D H B D E

(a) FIFO page replacement with

11 Faults

(b) LRU page replacement with 3

9 Faults

(c) OPT page replacement with 3

7 Faults

27. (7 points) Given five memory par
order), how would the first-fit, bes
Kb, 417 Kb, 112 Kb, and 426 Kb (
use of memory?

| 100 Kb | 500 Kb |
|---|---|
| | 212 Kb |
| | 417 Kb |
| | 417 Kb |

First-Fit

Best-Fit

Worst-Fit

**Multiple Choice (5 points each)**

1. Mutual exclusion can be done on
   - A. hardware level.
   - B. software level.
   - C. OS level.
   - D. All of the above
   - E. None of the above

2. A semaphore is a shared integer variable
   - A. that can not drop below zero
   - B. that can not be more than zero
   - C. that can not drop below one
   - D. that can not be more than one

3. A deadlocked state occurs whenever
   - A. a process is waiting for I/O to a device that does not exist.
   - B. the system has no available free resources.
   - C. every process in a set is waiting for an event that can only be caused by another process in the set.
   - D. a process is unable to release its request for a resource after use.

4. A _____ type presents a set of programmer-defined operations that are provided mutual exclusion within it.
   - A. transaction
   - B. signal
   - C. binary
   - D. monitor

5. A(n) _____ refers to where a process is accessing/updating shared data.
   - A. critical section

B. *entry section*

C. *mutex*

D. *test-and-set*

6. *What is the purpose of the mutex semaphore in the implementation of the bounded-buffer problem using semaphores?*

   (A) *It indicates the number of empty slots in the buffer.*

   B. *It indicates the number of occupied slots in the buffer.*

   C. *It controls access to the shared buffer.*

   D. *It ensures mutual exclusion.*

7. *When a semaphore is used to implement mutex lock, what is its value initialized to be?*

   A. *0*

   (B) *1*

   C. n, n>1

   D. n, n<0

8. *The following program consists of 3 concurrent processes and 3 binary semaphores. The semaphores are initialized as S0 = 1, S1 = 0, S2 = 0.*

```
Process P0
while(true)
{
    wait(S0);
    print '0';
    release(S1);
    release(S2);
}

Process P1
wait(S1);
release(S0);

Process P2
wait(S2);
release(S0);
```

*How many times will P0 print '0' ?*

(A) *At least twice*

B. *Exactly twice*

C. *Exactly thrice*



Please go on to the next page...

D. Exactly once

9. Which one of the following can not be scheduled by the kernel?
   A. kernel level thread
   B. user level thread
   C. process
   D. None of the above

10. When using semaphores, a process invokes the wait() operation before accessing its critical section, followed by the signal() operation upon completion of its critical section. Consider reversing the order of these two operations—first calling signal(), then calling wait(). What would be a possible outcome of this?
   A. Starvation is possible.
   B. Several processes could be active in their critical sections at the same time.
   C. Mutual exclusion is still assured.
   D. Deadlock is possible.

11. Which of the following condition is required for deadlock to be possible?
   A. Mutual exclusion.
   B. A process may hold allocated resources while awaiting assignment of other resources.
   C. No resource can be forcibly removed from a process holding it.
   D. All of the above

12. The circular wait condition can be prevented by _____.
   A. defining a linear ordering of resource types
   B. using thread
   C. using Banker's algorithm
   D. None of the above

13. The processes that are residing in main memory and are ready and waiting to execute are kept on a list called _____.
   A. job queue
   B. ready queue
   C. execution queue
   D. process queue

14. Which of the following scheduling algorithms must be nonpreemptive?

A. SJF
B. RR
C. FCFS
D. priority algorithms

15. 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.

16. Which of the following is true of multilevel queue scheduling?
    A. Processes can move between queues.
    B. Each queue has its own scheduling algorithm.
    C. A queue cannot have absolute priority over lower-priority queues.
    D. It is the most general CPU-scheduling algorithm.

17. A significant problem with priority scheduling algorithms is _____.
    A. complexity
    B. starvation
    C. determining the length of the next CPU burst
    D. determining the length of the time quantum

18. In multilevel feedback scheduling algorithm
    A. process can move to a different classified ready queue.
    B. classification of ready queue is permanent.
    C. processes are not classified into groups.
    D. None of the above

True or False (2 points each)

19. True/False F A deadlock-free solution eliminates the possibility of starvation.

20. True/False T A system in an unsafe state will ultimately deadlock.



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21. True/False T The monitor construct ensures that only one process can be active at a time within the monitor.

22. True/False F In RR scheduling, the time quantum should be small with respect to the context-switch time.

23. True/False T In the Linux CFS scheduler, the task with smallest value of *vruntime* is considered to have the highest priority.



End of