UDel CISC361-010 Final, December 13, 2001

Show your work! Partial credit will be given, but only if you show your work!
Be sure that you read each question and understand what it is asking.

1. (10 pts) True/False
   (a) T F - Segmentation is just another word for paging.
   (b) T F - Thrashing is when the disk head crashes.
   (c) T F - A smaller page size results in more internal fragmentation.
   (d) T F - Locality of programs makes using virtual memory useful.
   (e) T F - When using RPC the communication code can be generated automatically.
   (f) T F - Preemptive scheduling algorithms are generally better for response-time than nonpreemptive ones are.
   (g) T F - Using gang scheduling on multiprocessors involves less overhead than load sharing scheduling.
   (h) T F - With multiple cpus the specifics of the scheduling algorithm is more important than with a single cpu when there are a variety of unrelated processes.
   (i) T F - Linux and Solaris do not support real-time processes.
   (j) T F - Round-Robin scheduling is not fair to short processes.

2. (3 pts) Unix has 12 permission bits stored in a 16-bit value. How are the other 4 bits used?
   (a) They are reserved for future permissions.
   (b) They are wasted.
   (c) To denote the file type.
   (d) For system backups.

3. (3 pts) Belady’s Anomaly is when
   (a) two processes compete for one resource.
   (b) fewer page faults occur when a process has more page frames allocated to it.
   (c) a process runs better without using cache memory.
   (d) more page faults occur when a process has more page frames allocated to it.

4. (3 pts) What is the range of Unix nice values?
   (a) 0 to 19
   (b) -20 to 0
   (c) -32768 to 32767
   (d) -20 to 19

5. (3 pts) Using RAID-5 for 9 data disks would require how many total disks?
   (a) 9
   (b) 10
   (c) 11
   (d) 18

6. (3 pts) If we have 32-bit addresses and page sizes are 4k, how many bits in a logical address are used to offset into a page?
   (a) 10
   (b) 11
   (c) 12
   (d) 13
7. (3 pts) The resident set of a process is:
   (a) the pages currently resident in main memory.
   (b) the pages that are currently in main memory, plus pages that were in main memory, but have been paged out.
   (c) all pages belonging to a process.
   (d) the pages of a process not in main memory.

8. (3 pts) The clock algorithm is used to:
   (a) adjust the time on the system.
   (b) schedule processes on the cpu.
   (c) approx LRU with less overhead for page replacement.
   (d) calculate when daylight savings time begins and ends.

9. (2 pts) TCP is
   (a) not reliable, unordered, connection-less
   (b) reliable, ordered, connection-oriented
   (c) reliable, ordered, connection-less
   (d) reliable, unordered, connection-oriented

10. (2 pts) UDP is
    (a) not reliable, ordered, connection-less
    (b) not reliable, unordered, connection-oriented
    (c) not reliable, unordered, connection-less
    (d) reliable, ordered, connection-oriented

11. (3 pts) Routing between networks is done at what layer?
    (a) Network
    (b) Transport
    (c) Application
    (d) Data Link

12. (2 pts) In recent versions of Solaris an IA class process
    (a) always has a higher global priority over TS class processes.
    (b) has its priority increased when it has the current window focus.
    (c) should never get a chance to run.
    (d) runs before any RT process.

13. (4 pts) Describe the difference between internal and external fragmentation of memory. Give an example of each.
14. (3 pts) Why is it advantageous for a process to be rescheduled on the CPU it was running on previously rather than a new one?

15. (3 pts) With Solaris' scheduling algorithm why are lower priority threads given larger time quantum than higher priority threads?

16. (10 pts) Consider the organization of a UNIX file as represented by the inode. Assume that there are 12 direct block pointers and a singly, doubly, and triply indirect pointer in each inode. Further, assume that the system block size is 512 bytes (1/2 K). If the disk block pointer is 32 bits (4 bytes) what is the maximum file size supported by this system? Answer by completing this table (and show your work to maximize partial credit).

<table>
<thead>
<tr>
<th>Level</th>
<th>Number of Blocks</th>
<th>Number of Bytes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct</td>
<td>12</td>
<td>6K</td>
</tr>
</tbody>
</table>
| Single Indirect
| Double Indirect
| Triple Indirect |
17. (10 pts) A 2-MByte block of memory is allocated using the buddy system. Show the results of the following sequence in a similar figure as done in the homework.

A - Request 63K
B - Request 120K
C - Request 70K
Return A
D - Request 130K
Return B
Return D
Return C

18. (10 pts) Given the service time requirements of the following 5 processes, use shortest process next (SPN) to schedule them. Calculate the turnaround and wait times for each process. Assume all processes become ready at time 0. The wait time is simply the how long the process waits before it gets to run.

<table>
<thead>
<tr>
<th>Process</th>
<th>Service_Time</th>
<th>Running_Order</th>
<th>Turnaround_time</th>
<th>Wait_Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>300</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>100</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>600</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>D</td>
<td>200</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>E</td>
<td>25</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
19. (10 pts) Consider the two-dimensional 100x100 array A of integers, indexed from 0 to 99 on each dimension, where \( A[0][0] \) is at location 400, in a paged memory system with pages of size 400. (The array is stored row-major; that is the first data page may contain \( A[0][0], A[0][1], ..., A[3][99] \) and the second page may contain \( A[4][0], A[4][1], ..., A[7][99] \) and so on. (i.e. a page can hold 4 rows of the matrix)) A small process is in page 0 (locations 0 to 399) for manipulating the matrix; thus, every instruction fetch will be from page 0. For five page frames, how many page faults are generated by the following array-initialization loops, using the LRU replacement policy, and assuming page frame 0 has the process in it, and the other four are initially empty:

- for \( j = 0; j < 100, j++ \)  
  for \( i = 0; i < 100, i++ \)  
  \( A[i][j] = 0; \)

- for \( i = 0; i < 100, i++ \)  
  for \( j = 0; j < 100, j++ \)  
  \( A[i][j] = 0; \)
20. Suppose the read/write head is at track 100, moving toward track 199 (the highest-numbered track on the disk) and the disk request queue contains read/write requests for sectors on tracks 20, 130, 110, 180, 190, 40, 10, 60, 120, respectively. (Show your work for partial credit)

(a) *(5 pts)* What is the total number of head movements to satisfy the requests in the queue using the FCFS optimization strategy?

(b) *(5 pts)* What is the total number of head movements to satisfy the requests in the queue using the SSTF optimization strategy?

21. **Extra Credit**

*(5 pts)* Explain why using ssh for logins and ssl over certain web pages and other applications should be done.