

This exam is closed book. You can have one page of notes. UH expels cheaters.

1. True or False: (10×2 points; no penalty for incorrect answers)

- T \_\_\_ F **X**\_\_\_      *Monitor conditions* should always be initialized to zero.
- T \_\_\_ F **X**\_\_\_      Eliminating the *circular wait* condition requires all processes to receive all the resources they need before starting to use any of them.
- T \_\_\_ F **X**\_\_\_      The LRU policy always expels the page that has been the *least frequently referenced* since it was brought into main memory.
- T **X**\_\_\_ F \_\_\_      Many good programmers prefer to put all their *signal* operations at the end of their monitor procedures.
- T **X**\_\_\_ F \_\_\_      Memory compaction is used to fight *external fragmentation*.
- T **X**\_\_\_ F \_\_\_      An *inverted page table* only contains page table entries for the pages that are present in main memory.
- T \_\_\_ F **X**\_\_\_      A good page fault rate for a virtual memory system is one page fault every one thousand to two thousand references.
- T **X**\_\_\_ F \_\_\_      Doubling the page size of a virtual memory system also doubles the amount of main memory lost to *internal fragmentation*.
- T \_\_\_ F **X**\_\_\_      The *dirty bit* indicates which pages are *invalid*.
- T \_\_\_ F **X**\_\_\_      There are some problems that can be solved using *semaphores* and cannot be solved using *monitors*.

2. A 32-bit Berkeley UNIX file system has a block size of 8 kilobytes. How many *blocks* of a given file can be accessed :

- (a) Using the block addresses stored in the i-node? (5 points) \_\_\_\_\_ **12. blocks**
- (b) With one level of indirection? (5 points) \_\_\_\_\_ **8K/4 = 2,048 blocks**
- (c) With two levels of indirection? (5 points) **4G/8K-2060 = around 510K= 522228- blocks**

Explain in one line or less your answer to point (c) above. (5 points)

A file cannot contain more than 4 Gigabytes, that is 4G/8K= 512K pages of 8KB

Show below your computations for possible partial credit:

3. A computer has 32 bit addresses and a virtual memory with a page size of 8 kilobytes. (2×5 points)

(a) How many bits are used by the *byte offset*? 13 bits

(b) What is the maximum size of a *page table*?  $2^{19} = 512K = 524288$  entries

Show below your computations for possible partial credit:

4. It has been said that the UNIX file system uses at the same time access control lists and tickets to protect its file. What are the UNIX entities playing the role of:

(a) An *access control list*? (5 points) the [access control bits in the] i-node

(b) A *ticket*? (5 points) the file descriptor

5. Are the following statements true or false for the three following file allocation methods? (5 points per correct line; no partial credits)

| <i>This file allocation method</i>                     | <i>Contiguous</i>      | <i>Linked</i>          | <i>Indexed</i>         |
|--|------------------------|------------------------|------------------------|
| Handles very poorly <i>direct access</i> .             | T <u>  </u> F <u>X</u> | T <u>X</u> F <u>  </u> | T <u>  </u> F <u>X</u> |
| Handles well files whose <i>size varies</i> over time. | T <u>  </u> F <u>X</u> | T <u>X</u> F <u>  </u> | T <u>  </u> F <u>X</u> |
| Avoids external fragmentation.                         | T <u>  </u> F <u>X</u> | T <u>X</u> F <u>  </u> | T <u>X</u> F <u>  </u> |
| Remains the <i>best overall choice</i> .               | T <u>  </u> F <u>X</u> | T <u>  </u> F <u>X</u> | T <u>X</u> F <u>  </u> |

6. Are the following statements true or false for the three following page replacement policies? (5 points per correct line; no partial credits)

| <i>This page replacement policy</i>                 | <i>VMS</i>             | <i>Mach</i>            | <i>Global LRU</i>      |
|---|------------------------|------------------------|------------------------|
| Was designed to handle <i>real-time processes</i> . | T <u>X</u> F <u>  </u> | T <u>  </u> F <u>X</u> | T <u>  </u> F <u>X</u> |
| Is compatible with most existing architectures.     | T <u>X</u> F <u>  </u> | T <u>X</u> F <u>  </u> | T <u>  </u> F <u>X</u> |
| Is partially based on the FIFO policy.              | T <u>X</u> F <u>  </u> | T <u>X</u> F <u>  </u> | T <u>  </u> F <u>X</u> |
| Is well known for its <i>excessive overhead</i> .   | T <u>  </u> F <u>X</u> | T <u>  </u> F <u>X</u> | T <u>X</u> F <u>  </u> |