Final Exam Topics and Sample Questions

1 Topics

Questions on the final exam may be drawn from any of the material contained in the chapter summaries, starting with Chapter 6, *Hardware support for mutual exclusion*, through the end of Chapter 12.

2 Sample Questions

Following are ***sample*** questions for the final exam. They are not a list of the questions that will be on the exam, nor are they representative of the topics that might be on the exam. They are just to give you an idea of the difficulty and types of questions you will find on the exam. The exam may have True/False, multiple choice, and short answer questions. The questions that ask for numeric answers could be multiple choice or fill in.

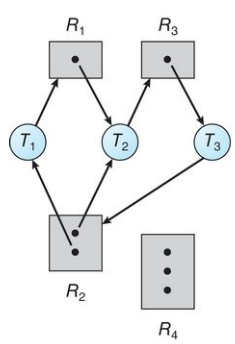
1. (60%) **True/False**.

   ☐ In a multiprocessor system, mutual exclusion to a section of code can be guaranteed by disabling interrupts before starting the code and enabling them after the code.

   ☐ An instruction that executes atomically must consist of a single machine instruction.

   ☐ Livelock occurs among a system of threads when a thread continuously attempts an action that fails.

   ☐ The resource allocation graph below represents a deadlock state.



2. Give the solution to the weak-reader preference reader-writer problem below

```
1. wait(mutex);
2. rc := rc + 1;
3. if rc = 1 then wait(writer);
4. signal(mutex);
   perform reading
5. wait(mutex);
6. rc := rc − 1;
7. if rc = 0 then signal(writer);
8. signal(mutex);
```

(a) If we replaced line 5 by the line
`wait (mutex2);`
and we replace line 8 by the line
`signal (mutex2);`

is the code still correct?

3. Given six memory partitions of 300 KB, 600 KB, 350 KB, 200 KB, 750 KB, and 125 KB (in order), how much external fragmentation occurs after the first-fit, best-fit, and worst-fit algorithms place processes of size 115 KB, 500 KB, 358 KB, 200 KB, and 375 KB (in the given order)?

4. Given the following snapshot of a resource allocation system in which there are no current outstanding, unsatisfied requests.

	Maximum Claim				**Current Allocation**			
process	R_1	R_2	R_3	R_4	R_1	R_2	R_3	R_4
P_1	0	0	1	2	0	0	1	2
P_2	2	7	5	0	2	0	0	0
P_3	6	6	5	6	0	0	3	4
P_4	4	3	5	6	2	3	5	4
P_5	0	6	5	2	0	3	3	2

Available			
R_1	R_2	R_3	R_4
2	1	0	0

is the resulting system in a safe or an unsafe state?

5. Given a current state of processes and resources represented by an allocation matrix, a maximum claim matrix, and an availability vector, is a given sequence a safe sequence for it?

6. Consider a logical address space of 256 pages with a 4-KB page size, mapped onto a physical memory of 64 frames. How many bits are required in the logical address? How many bits in a physical address?

7. What is the effective memory access time if the TLB hit ratio is 99%, one-level paging is used, and a memory access takes 100 microseconds, assuming all pages are valid?

8. Given a reference string generated by a process, how many page faults occur with N frames if page replacement is by LRU, or FIFO, or the optimal algorithm.

9. Given a reference string, if the working set window is of size N, how many page "faults" will occur, meaning if the window is used to allocate frames, how many times is a reference not in the current working set?
10. Given a particular page table and page size, given a logical address, what is its physical address?
11. Given a two-level paging system with a TLB as shown (figure omitted) what is the physical address? How many memory references were necessary to access it?