

CPE 460: OPERATING SYSTEMS DESIGN

Final Exam, May 27, 2017

- This is a **120-minute** OPEN BOOK exam, with a total of **35 marks**. There are **40 questions**, and **8 pages** (including this cover page).
- All your answers to multiple choice questions must be marked on this answer sheet. We will **not** take into consideration anything written on the question booklet or if multiple markings are made on the answer sheet. Make sure to mark only one answer.

GOOD LUCK

Total Grade
/35

Serial No

Name

- 1 (A) (B) (C) (D) 20 (A) (B) (C) (D) 30 (A) (B) (C) (D) 40 (A) (B) (C) (D)
- 2 (A) (B) (C) (D) 21 (A) (B) (C) (D) 31 (A) (B) (C) (D)
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Student ID

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2	2	2	2	2	2	2	2	2	2
3	3	3	3	3	3	3	3	3	3
4	4	4	4	4	4	4	4	4	4
5	5	5	5	5	5	5	5	5	5
6	6	6	6	6	6	6	6	6	6
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8	8	8	8	8	8	8	8	8	8
9	9	9	9	9	9	9	9	9	9

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1. In the **one-to-one** model, when a user thread makes a blocking system call:
 - (A) other user threads are strictly prohibited from running
 - (B) other user threads are allowed to run
 - (C) other user threads only from other processes are allowed to run
 - (D) none of the above
2. A solution to the **external fragmentation** problem is to:
 - (A) permit the logical address space of a process to be noncontiguous
 - (B) permit smaller processes to be allocated memory at last
 - (C) permit larger processes to be allocated memory at last
 - (D) all of the above
3. _____ is generally faster than _____ and _____.
 - (A) first-fit, best-fit, worst-fit
 - (B) best-fit, first-fit, worst-fit
 - (C) worst-fit, best-fit, first-fit
 - (D) none of the above
4. A thread shares its resources (like data section, code section, open files, signals) with:
 - (A) other process similar to the one that the thread belongs to
 - (B) other threads that belong to similar processes
 - (C) other threads that belong to the same process
 - (D) all of the mentioned
5. If one thread opens a file with read privileges then _____
 - (A) other threads in the another process can also read from that file
 - (B) other threads in the same process can also read from that file
 - (C) any other thread can not read from that file
 - (D) no other thread can ready from the file
6. The time required to create a new thread in an existing process is _____
 - (A) greater than the time required to create a new process
 - (B) less than the time required to create a new process
 - (C) equal to the time required to create a new process
 - (D) none of the mentioned
7. The major part of swap time is _____ time.
 - (A) waiting
 - (B) transfer
 - (C) execution
 - (D) turnaround

8. The kernel is _____ of user threads.
- (A) a part of
 - (B) the creator of
 - (C) unaware of
 - (D) aware of
9. The first-fit, best-fit and worst-fit are strategies to select a _____.
- (A) process from a queue to put in memory
 - (B) processor to run the next process
 - (C) free hole from a set of available holes
 - (D) all of the above
10. The operating system and the other processes are protected from being modified by an already running process because:
- (A) they are in different memory spaces
 - (B) they are in different logical addresses
 - (C) they have a protection algorithm
 - (D) every address generated by the CPU is being checked against the relocation and limit registers
11. A process having multiple threads of control implies:
- (A) it can do more than one task at a time
 - (B) it can do only one task at a time, but much faster
 - (C) it has to use only one thread per process
 - (D) none of the above
12. If a kernel thread performs a blocking system call, _____.
- (A) the kernel can schedule another thread in the application for execution.
 - (B) the kernel cannot schedule another thread in the same application for execution.
 - (C) the kernel must schedule another thread of a different application for execution.
 - (D) the kernel must schedule another thread of the same application on a different processor.
13. External fragmentation exists when:
- (A) enough total memory exists to satisfy a request but it is not contiguous
 - (B) the total memory is insufficient to satisfy a request
 - (C) a request cannot be satisfied even when the total memory is free
 - (D) none of the above
14. Which one of the following is **not** shared by the threads of a single process?
- (A) program counter
 - (B) heap segment
 - (C) code segment
 - (D) CPU

15. Thread synchronization is required because _____
- (A) all threads of a process share the same address space
 - (B) all threads of a process share the same global variables
 - (C) all threads of a process can share the same files
 - (D) all of the mentioned
16. If multiple threads are concurrently searching through a database and one thread returns the result, then the remaining threads must be :
- (A) continued
 - (B) cancelled
 - (C) protected
 - (D) paused
17. Which of the following is the drawback of the **one-to-one** model?
- (A) increased concurrency provided by this model
 - (B) decreased concurrency provided by this model
 - (C) creating so many threads at once can crash the system
 - (D) creating a user thread requires creating the corresponding kernel thread
18. The address generated by the CPU is referred to as _____.
- (A) physical address
 - (B) logical address
 - (C) absolute address
 - (D) relative address
19. Because the kernel thread management is done by the Operating System itself:
- (A) kernel threads are faster to create than user threads
 - (B) kernel threads are slower to create than user threads
 - (C) kernel threads are easier to manage as well as create than user threads
 - (D) none of these

Use the following information to answer questions 20–21.

Imagine that your main memory is split into 5 segments: $S_1 : 50KB, S_2 : 200KB, S_3 : 70KB, S_4 : 115KB, S_5 : 15KB$, where S_1 starts from the lowest address space, then S_2, S_3 , and S_4 , finally S_5 ends at the highest address space and you have the following processes arriving into the input queue based on their **arrival time** to be allocated in memory for the **needed time units**.

Processes	P_1	P_2	P_3	P_4	P_5	P_6	P_7	P_8	P_9	P_{10}
Arrival Time	0	0	1	1	2	5	8	8	9	10
Time Units Needed	2	3	3	1	2	2	3	5	4	1
Process Size (KB)	100	10	35	15	23	6	25	55	88	100

Note that $S_i : \emptyset$ means there is no content in segment S_i .

20. Using **first-fit** memory management, what are the contents of the memory segments $(S_1, S_2, S_3, S_4, S_5)$ directly after the arrival and allocation of P_4 ?
- (A) $(P_2, P_1, P_3, P_4, \emptyset)$
 - (B) $(P_3, \emptyset, P_4, P_1, P_2)$
 - (C) $(P_4, P_1, P_3, P_2, \emptyset)$
 - (D) $(P_2, P_5, P_3, \emptyset, \emptyset)$
21. Using **best-fit** memory management, what are the contents of the memory segments $(S_1, S_2, S_3, S_4, S_5)$ directly before the arrival and allocation of P_6 ?
- (A) $(\emptyset, \emptyset, \emptyset, \emptyset, \emptyset)$
 - (B) $(\emptyset, P_5, P_3, \emptyset, \emptyset)$
 - (C) $(P_3, \emptyset, P_5, \emptyset, \emptyset)$
 - (D) $(\emptyset, \emptyset, \emptyset, \emptyset, P_6)$
22. What is the total size of internal fragmentation after the arrival and allocation of P_1 and P_2 using **worst-fit** memory management?
- (A) 0
 - (B) 20
 - (C) 140
 - (D) 205
23. The segment base contains the:
- (A) starting logical address of the process
 - (B) starting physical address of the segment in memory
 - (C) segment length
 - (D) the start of the memory address
24. External fragmentation will not occur when:
- (A) first-fit is used
 - (B) best-fit is used
 - (C) worst-fit is used
 - (D) no matter which algorithm is used, it will always occur
25. The _____ swaps processes in and out of the memory.
- (A) memory manager
 - (B) CPU
 - (C) CPU manager
 - (D) user
26. CPU fetches the instruction from memory according to the value of _____.
- (A) program counter
 - (B) status register
 - (C) instruction register
 - (D) program status word

Use the following tables containing information about the processes P_1, P_2 and P_3 , their segments and the corresponding memory contents, and the associated segmentation tables to answer questions 27–28.

Process 1	<i>Segment</i>	0				1				2				3			
	<i>Virtual Address</i>	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	<i>Memory Content</i>	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p
Process 2	<i>Segment</i>	0				1				2							
	<i>Virtual Address</i>	0	1	2	3	4	5	6	7	8	9	10	11				
	<i>Memory Content</i>	A	B	C	D	E	F	G	H	I	J	K	L				
Process 3	<i>Segment</i>	0				1				2				3			
	<i>Virtual Address</i>	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	<i>Memory Content</i>	O	P	Q	R	S	T	U	V	W	X	Y	Z	w	x	y	z

Process 1	<i>Segment</i>	0	1	2	3
	<i>Limit Register</i>	4	4	4	4
	<i>Base Register</i>	100	200	216	320
Process 2	<i>Segment</i>	0	1	2	
	<i>Limit Register</i>	4	4	4	
	<i>Base Register</i>	120	616	620	
Process 3	<i>Segment</i>	0	1	2	3
	<i>Limit Register</i>	4	4	4	4
	<i>Base Register</i>	104	116	212	624

27. What are the memory contents from the physical address 212 to the physical address 215?

- (A) A, B, C, D
- (B) a, b, c, d
- (C) e, f, g, h
- (D) W, X, Y, Z

28. What are the memory contents from the physical address 622 to the physical address 625?

- (A) K, L, w, x
- (B) I, J, K, L
- (C) E, F, G, H
- (D) W, X, Y, Z

29. In **many-to-one** model, multiple user threads **cannot** run in parallel on multiprocessors because:

- (A) only one user thread can access the kernel at a time
- (B) many user threads have access to just one kernel thread
- (C) there is only one kernel thread
- (D) none of the above

30. Which of the following is **FALSE**?
- (A) Context switch time is longer for kernel threads than for user threads
 - (B) User threads do not need any hardware support
 - (C) Related kernel threads can be scheduled on different processors in a multiprocessor system
 - (D) Blocking one kernel thread blocks all other related threads
31. Generally, swapping _____ be done when a process has pending I/O, or has to execute I/O operations only into operating system buffers.
- (A) can
 - (B) must
 - (C) must carefully
 - (D) must never
32. When memory is divided into several fixed-sized partitions, each partition may contain:
- (A) exactly one process
 - (B) at least one process
 - (C) multiple processes at once
 - (D) none of the above
33. The segment offset d of the logical address must be:
- (A) greater than segment limit
 - (B) between 0 and segment limit
 - (C) between 0 and the segment number
 - (D) greater than the segment number
34. Resource sharing helps:
- (A) share the memory and resources of the process to which the threads belong.
 - (B) an application have several different threads of activity all within the same address space
 - (C) reduce the address space that a process could potentially use
 - (D) all of the mentioned
35. In fixed-sized partition, the degree of multiprogramming is bounded by _____.
- (A) the number of partitions
 - (B) the CPU utilization
 - (C) the memory size
 - (D) all of the above
36. If the segment offset is legal:
- (A) it is used as a physical memory address itself
 - (B) it is subtracted from the segment base to produce the physical memory address
 - (C) it is added to the segment base to produce the physical memory address
 - (D) none of these

37. The run-time mapping from virtual to physical addresses is done by a hardware device called:
- (A) virtual to physical address mapper
 - (B) memory management unit
 - (C) memory mapping unit
 - (D) CPU mapper
38. What is memory compaction?
- (A) a technique for overcoming internal fragmentation
 - (B) a segmentation technique
 - (C) a technique for overcoming external fragmentation
 - (D) a technique for overcoming fatal error
39. The address loaded into the memory address register of the memory is referred to as:
- (A) physical address
 - (B) logical address
 - (C) absolute address
 - (D) relative address
40. The **disadvantage** of moving all process to one end of memory and all holes to the other direction, producing one large hole of available memory is:
- (A) the cost and time incurred
 - (B) the memory used
 - (C) the CPU used
 - (D) none of the above

(3 points) During the second exam, I quickly mentioned that only a pink pen will save you on the Final Exam. Draw a smiley face below using a pink pen.