Gujarat Technological University

MCA III Semester

2630004 – Operating Systems

<table>
<tr><td>1</td><td>Consider a logical address space of 8 pages of 1024 words mapped into memory of 32 frames.
a. How many bits are there in the logical address?
b. How many bits are there in physical address?</td><td>4</td></tr>
<tr><td>2</td><td>Consider the segment table:
What are the physical address for the following logical addresses :
a. 0,430
b. 1,10
c. 1,11
d. 2,500
Segment Base Length
<table>
<tr><td>0</td><td>219</td><td>600</td></tr>
<tr><td>1</td><td>2300</td><td>14</td></tr>
<tr><td>2</td><td>90</td><td>100</td></tr>
<tr><td>3</td><td>1327</td><td>580</td></tr>
<tr><td>4</td><td>1952</td><td>96</td></tr>
</table></td><td>4</td></tr>
<tr><td>3</td><td>On a system with paging, a process cannot access memory that it does not own; why? How could the operating system allow access to other memory? Why should it or should it not?</td><td>3</td></tr>
<tr><td>4</td><td>A computer has 32-bit virtual addresses and 4-KB pages. The program and data together fit in the lowest page (0-4095) the stack fits in the highest page. How many entries are needed in the page table if traditional (one-level) paging is used? How many page table entries are needed for two level paging, with 10 bits in each part?</td><td>4</td></tr>
<tr><td>5</td><td>A computer whose processes have 1024 pages in their address spaces keeps its page tables in memory. The overhead required for reading a word from the page table is 5 nsec. To reduce this overhead, the computer has a TLB, which holds 32 (virtual page, physical page frame) pairs, and can do a look up in 1 nsec. What hit rate is needed to reduce the mean overhead to 2 nsec?</td><td>3</td></tr>
<tr><td>6</td><td>If an instruction takes 10nsec and a page takes an additional n nsec, give a formula for the effective instruction time if page faults occur every k instructions.</td><td>2</td></tr>
<tr><td>7</td><td>Two versions of a program P, called Ps and Pd, are developed using static and dynamic memory allocation, respectively. When an effort is made to execute Ps, an OS gives the message “Insufficient memory, cannot run the program.” However, the same OS executes program Pd without any difficulties. Explain why this happens.</td><td>3</td></tr>
<tr><td>8</td><td>Explain why free lists in a buddy system are doubly linked.</td><td>2</td></tr>
<tr><td>9</td><td>A buddy system allocator is allocated an area of 64K bytes. Blocks of size 2K, 11K, 120 bytes and 20K are allocated in that order.
(a) Show the allocation status and free lists of the allocator. How many splits were performed?
(b) Show the allocation status and free lists of the allocator after the</td><td>7</td></tr>
</table>

	block of 120 bytes is freed. How many coalesce operations were performed? **(c) Determine the value of n if the minimum block size in the buddy system is 16 bytes.**	
10	**Justify the statement: "When a block is released in a buddy system the number of free blocks in the system may increase by 1, may remain unchanged, or may decrease by a number between 1 and n, both inclusive, where n depends on the memory available with the system."**	3
11	**The kernel of an OS receives requests for memory allocation at a high rate. It is found that a large fraction of the requests are for memory areas of size 100, 300 and 400 bytes (we call these as 'standard' sizes). Other requests are for areas of various other sizes. Design a memory allocation scheme in which no fragmentation arises while allocating areas of other sizes.**	5
12	**The size of physical memory allocated to a process in a paged virtual memory system is held constant and the page size is varied. (This action varies the number of pages of the process in memory). Draw a graph of page size vs. Expected page fault rate.**	3
13	**What is the distinction between a process address space and the primary memory addresses?**	3
14	**Why is compaction considered to be costly affair?**	2
15	**If a computer system does not have relocation hardware yet it implements swapping, then the memory manager will have to use a loader to recompute the executable image from the absolute image. Would it be possible for the swapping system to reload the data and stack segments? Explain how such a system might work, or why it would be impossible.**	3
16	**What is swapping? How does swapping optimize system performance?**	3
17	**In dynamic memory management, "Best-fit" strategy leaves smaller holes than "worst-fit" strategy - state their relative advantages and disadvantages?**	3
18	**Why are the page size, the number of pages in the virtual address space, and the number of page frames in the physical address space all a power of 2 in binary machines?**	3
19	**What factors could influence the size of the virtual address space in a modern computer system?**	3
20	**What factors could influence the size of the physical address space in a modern computer system? (Consider various parts of the hardware).**	3
21	**Consider a page reference string of a process with a working set of F frames, initially all empty. The page reference string is of Length L with P distinct page numbers in it. For any page replacement algorithm** **(a) What is the lower bound on the number of page faults?** **(b) What is an upper bound on the number of page faults?**	2
22	**Assume a task is divided into 4 equals-sized segments and the system builds an 8-entry page descriptor table for each segment. The system, therefore, has a combination of segmentation and paging. Assume that page size is 2KB.** **(a) What is the maximum size of each segment?** **(b) What is the maximum logical address space for this task?**	4
23	**In a paging system, page boundaries are transparent to the programmer.**	3

	Explain how a loop might cause thrashing in a static allocation paging system when the memory allocation is too small.	
24	**Do you think that the Least Recently Used (LRU) page replacement strategy possesses the property of stack? Why or why not?**	3
25	**Why may Least Recently Used (LRU) page replacement strategy not suffer from Belady's anomaly?**	3
26	**Which scheduling policy is most suitable for time-shared operating systems? Why?**	2
27	**Explain how it might be possible to build an OS that uses full segmentation, but has no file syste.**	3