	Marks obtained ↓

CS 304 Operating Systems Quiz-3

Date: 26.03.2021,   Total questions: **10**   Total Marks: **15**

Name: SAMPLE   Roll No: ANSWERS   Time: 30 min

Question:	1	2	3	4	5	6	7	8	9	10	Total
Points:	2	2	2	2	1	1	1	2	1	1	15
Score:											

Instructions:

1. **Please write the answer for each question ONLY in the space provided below the question.**

2. **No electronic gadgets are allowed.**

2 1. Consider a system with N bytes of physical RAM, and M bytes of virtual address space per process. Pages and frames are K bytes in size. Every page table entry is P bytes in size, accounting for the extra flags required and such. Calculate the size of the page table of a process.

> **Solution:**
>
> $$\frac{M}{K} * P$$

2 2. Consider a process with 9 logical pages, out of which 3 pages are mapped to physical frames. The process accesses one of its 9 pages randomly. What is the probability that the access results in a TLB hit and a subsequent page fault?

> **Solution:**
>
> 0 (TLB Hit implies a physical page has been mapped, so a page fault cannot occur)

2 3. A certain page table entry in the page table of a process has both the valid and present bits set. Describe what happens on a memory access to a virtual address belonging to this page table entry.
(a) What happens at the TLB? (hit/miss/cannot say) – Explain why?
(b) Will a page fault occur? (yes/no/cannot say) – Explain why?

> **Solution:** ~~Miss~~ a) Cannot say (Because with present bit and valid bit set, we do not know what is happening in
>
> b) NO [Because ~~valid~~ Present bit is sent]

2   4. Consider a system with 16 bit virtual addresses, 256 byte pages, and 4 byte page table entries. The OS builds a multi-level page table for each process. Calculate the maximum number of pages required to store all levels of the page table of a process in this system.

> Solution: No. of Page Table Entry per Process $= 2^{16}/2^8 = 2^8$
>
> No. of PTE per page $= 2^8/2^2 = 2^6$
>
> No. of inner page-table pages $= 2^8/2^6 = 4$ which requires one outer page for directory $= 4+1 = \boxed{5}$ [Max no. of Pages reqd]

1   5. The following page table has the same number of entries as there are physical page frames: (a)multilevel page table (b)inverted page table (c)direct mapped page table (d) associatively mapped page table (e) none of the above. Write the correct option/s in the given box below

> Solution: (b) Inverted page table.

1   6. Large page sizes increase: (a)Internal fragmentation (b)External fragmentation (c)The page table size (d)The working set size (e)all of the above . Write the correct option/s in the given box below

> Solution: (a) Internal Fragmentation

1   7. Thrashing occurs when: (a)The sum of the working sets of all processes exceeds available memory. (b)The scheduler flip-flops between two processes, leading to the starvation of others. (c)Two or more processes compete for the same region of shared memory and wait on mutex locks. (d)Multiple processes execute in the same address space. (e) None of the above. Write the correct option/s in the given box below

> Solution: Ans (a) The Sum of the working sets > available memory. The OS tries to keep each process's working set in memory. The Working set size of a process is the No. of pages that make up the working set. The WSS > phy. mem, then we end up moving frequently used pages bet and leads to thrashing. [b) would be starvation not thrasing c) is process synchronization. d) This does not make sense → each process has its own address space.]

2   8. You are using a buddy algorithm that allocates storage from 16-byte blocks up to 1024-byte blocks. What percentage of allocated memory is wasted due to internal fragmentation when satisfying requests for allocating 130-byte chunks? Show your calculations.

Solution: Approximately 50%

Buddy algo allocates blocks of memory in powers of two

If we need 130 bytes, We need to ask 256 bytes

Wasted Space = 256 − 130 = ~~256~~ 126 bytes

% Wastage = $\frac{126}{256} \times 100$ = 0·492 × 100. ∼ 50%.

9. In contrast to segmentation, paging: (a)Requires real-time address translation. (b)Requires less memory to store memory address translation tables. (c) Divides memory into fixed-size chunks. (d) Requires that a process be allocated a contiguous chunk of memory. (e) All of the above. Write the correct option/s in the given box below

Solution: Ans (C) Divides memory into fixed size Chunks

10. The memory addresses generated by the CPU when executing instructions of a process are called logical addresses. [True/False] . Write the correct option/s in the given box below

Solution: True.