CS4448 Assignment6 Solution

1. An address generated by a CPU is referred to as a ____.

A) physical address
B) logical address
C) post relocation register address
D) Memory-Management Unit (MMU) generated address

Ans: B

2. Suppose a program is operating with execution-time binding and the physical address generated is 300. The relocation register is set to 100. What is the corresponding logical address?

A) 199
B) 201
C) 200
D) 300

Ans: C

3. The mapping of a logical address to a physical address is done in hardware by the _____.

A) memory-management-unit (MMU)
B) memory address register
C) relocation register
D) dynamic loading register

Ans: A

4. _____ is the dynamic storage-allocation algorithm which results in the smallest leftover hole in memory.

A) First fit
B) Best fit
C) Worst fit
D) None of the above

Ans: B

5. _____ is the dynamic storage-allocation algorithm which results in the largest leftover hole in memory.

A) First fit
B) Best fit
C) Worst fit
D) None of the above

Ans: C

6. A(n) ____ page table has one page entry for each real page (or frame) of memory.
A) inverted
B) clustered
C) forward-mapped
D) virtual

Ans: A

7. Consider a logical address with a page size of 8 KB. How many bits must be used to represent the page offset in the logical address?
A) 10
B) 8
C) 13
D) 12

Ans: C

8. Assume a system has a TLB hit ratio of 90%. It requires 15 nanoseconds to access the TLB, and 85 nanoseconds to access main memory. What is the effective memory access time in nanoseconds for this system?
Effective Access Time (EAT)

$$EAT = (85 + 15) * 0.9 + (2*85 + 15)(1 - 0.9) = 90+18.5=108.5 \text{ nanoseconds}$$

9. Given the logical address 0xAEF9 (in hexadecimal) with a page size of 256 bytes, what is the page number?
A) 0xAE
B) 0xF9
C) 0xA
D) 0x00F9

Ans: A

10. Given the logical address 0xAEF9 (in hexadecimal) with a page size of 256 bytes, what is the page offset?
A) 0xAE
B) 0xF9
C) 0xA
D) 0xF900

Ans: B

11. Consider a 32-bit address for a two-level paging system with an 8 KB page size. The outer page table has 1024 entries. How many bits are used to represent the second-level page table?
A) 10

B) 8
C) 12
D) 9

Ans: D

12. With segmentation, a logical address consists of _____.
A) segment number and offset
B) segment name and offset
C) segment number and page number
D) segment table and segment number

Ans: A

13. Assume the value of the base and limit registers are 1200 and 350 respectively. Which of the following addresses (physical) is legal?
A) 355
B) 1200
C) 1551
D) all of the above

Ans: B

14. What is the advantage of using dynamic loading?

Ans: With dynamic loading a program does not have to be stored, in its entirety, in main memory. This allows the system to obtain better memory-space utilization. This also allows unused routines to stay out of main memory so that memory can be used more effectively. For example, code used to handle an obscure error would not always use up main memory.

15. Consider the following segment table

Segment	Base	Length
0	219	600
1	2300	14
2	2500	1000
3	1327	580
4	1952	96

What are the physical addresses for the following logical addresses. (all numbers we used here are decimal numbers (base 10))

a) 0,430
b) 1,10

c) 2,500
d) 3,400
e) 4,112

Ans:
a. 219 + 430 = 649
b. 2300 + 10 = 2310
c. 2500+500=3000
d. 1327 + 400 = 1727
e. illegal reference, trap to operating system

16. Two-Level Page-Table (***base 16 address***)

Logical address format

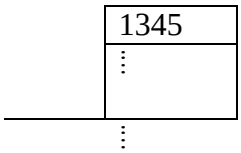
P1 8bits	P2 8bits	d 8bits

Outer page table

0	001A
1	001B
2	001C
3	0019

main memory

	⋮
0019	0056
	0144
	0036
	⋮
001A	0030
	0026
	0015
	0078
	60AF
	60F3
	⋮
001B	0023
	0079
	0065
	⋮
001C	0099
	1102
	0088
	⋮
001D	1125
	1456



Generate physical addresses for the following logical addresses.

a) 0004F9
b) 010256
c) 0301AB
d) 0005AD

Ans:

a) 60AFF9
b) 006556
c) 0144AB
d) 60F3AD

17. Hash page table. (***base 16 address***)

Logical address 24 bits

Each page/frame 4k

Hash function is page_number%8

→(page_number, frame_number)

0	→(0,0FA)→(8,035)→(16,052)
1	→(1,08B)→(9,025)
2	→(2,432) →(10,0AB)
3 . . .	. . .

Generate physical addresses for the following logical addresses.

a) 000FF1
b) 008A3B
c) 009359
d) 00A08B
e) 0020FA

Ans:

a) 0FAFF1
b) 035A3B
c) 025359
d) 0AB08B
e) 4320FA