CSE321 - Operating Systems
Quiz 3
Section __ (Set A)

Date:

Full name: Roll:

Total Marks: 15

1. Answer the following:
    a. Explain metadata with examples.
    b. What is the difference between Data journaling and Metadata journaling?
    c. What is the crash scenario when only Inode is updated?
    d. A file system has inode size = **512B** and block size = **4KB**. The first **3** blocks contain superblock, data bitmap and inode bitmap. Now calculate the address of the inode number **23**. The disk is sector addressable and the size of each sector is **256 B**. Find out the sector address of the inode block.
    e. A file system uses UNIX inode data structure which contains **10 direct block** addresses, **1 single** indirect blocks, **2 double** indirect blocks and **3 triple** indirect blocks. The size of **each block is 1 KBytes** and the size of **each block address is 4 Bytes**. Find the maximum possible file size.

Answer:

a. Metadata is the data of a file. For example, the name, size, type, creation date etc. are metadata.
b. Data journaling requires the new data to be written into the journal entries first, then again to data blocks after checkpointing. Metadata journaling directly writes the new data to the data block, not in journal entries.
c. When only inode is updated, it will cause inconsistency and garbage data
d. (floor the decimal value obtained from finding block number) 80
e. 1KB = 1024B, 1024/4 = 256pointers. Max size = 50462986KB

2. A file named 321-2324 is to be created. 2 data blocks are then allocated in the file. Write the Access Path Timeline for the system calls **create(/CSE/321-2324)** and **read()** for the data.

Answer: draw table with correct column headings. I have deducted marks for headings containing foo and bar.
Follow the access path of the part of create function
Then only need to follow the access path of the part of the read function for the 2 data blocks

CSE321 - Operating Systems
Quiz 3
Section __ (Set B)

Date:

Full name: Roll:

Total Marks: 15

1. Answer the following:
    a. Explain Superblock with examples.
    b. What is the difference between Data journaling and Metadata journaling?
    c. What is the crash scenario when only Inode and Bitmap are updated?
    d. A file system has inode size = **512B** and block size = **4KB**. The first **3** blocks contain superblock, data bitmap and inode bitmap. Now calculate the address of the inode number **27**. The disk is sector addressable and the size of each sector is **256 B**. Find out the sector address of the inode block.
    e. A file system uses UNIX inode data structure which contains **6 direct block** addresses, **3 single** indirect blocks, **2 double** indirect blocks and **2 triple** indirect blocks. The size of **each block is 1 KBytes** and the size of **each block address is 4 Bytes**. Find the maximum possible file size.

Answer:

a. Superblock is the block in the file system which stores information about the file system, for example: total blocks, inode start, data block start, block size etc.
b. Data journaling requires the new data to be written into the journal entries first, then again to data blocks after checkpointing. Metadata journaling directly writes the new data to the data block, not in journal entries.
c. When only inode and bitmap is updated, the system may look consistent but will show garbage data.
d. (floor the decimal value obtained from finding block number) 96
e. 1KB = 1024B, 1024/4 = 256pointers. Max size = 33686278KB

2. A file named 2423 is to be opened. 2 data blocks are already allocated in the file, we want to append 2 more blocks at the end of the file. Write the Access Path Timeline for the system calls **open(/CSE/321/2423)** and **write()** only for appending the data.

Answer: draw table with correct column headings. I have deducted marks for headings containing foo and bar.
Follow the access path of the part of open function
Then only need to follow the access path of the part of the write function for the data blocks **2423 data [2]** and **2423 data [3]** as the blocks 0 and 1 already exist and you need to append 2 new blocks.

CSE321 - Operating Systems
Quiz 4
Section __ (Set A)

Date:

Full name: ID:

Total Marks: 15

1. Answer the following:
    a. Arrange register, main memory and cache from most to least access time.
    b. What is Logical address?
    c. Logical memory vs. Physical memory.
    d. What is PTBR?
    e. Find Effective Access Time for memory access of 130ns, ε = 25ns, α = 96%

Answer: a. Main memory > cache > register
B. Address of the process generated by CPU
C. logical memory is memory that a process sees, physical memory is the actual memory Generated by cpu , translated by mmu
D. Page table base register, points to base of page table in memory
E. 155*0.96+285*0.04 = 160.2ns

Set A, ID:

1. A process runs in a system with multi level paging and it has a logical address space of 16 bits. In the system page size is 32 Bytes, size of each entry of the page table is 2 Bytes and size of the main memory is 512 KB. In order to fit the pages of the process in the main memory the OS applies a two-level paging technique in outer page number bits of the logical address space until the outer most page table can be allocated in a frame of the main memory.
    a. Illustrate the logical address space of the process including the necessary outer page bits, inner page bits and offset bits of every step with proper mathematical calculations during the paging mechanism of the system described above.

b. In this system, if the CPU generates logical addresses 23352 and 36758 then map the corresponding physical addresses of these logical addresses.

Necessary page table information is given below

2nd Outer table	
Page #	Frame #
0	8
1	2
2	6
3	
4	1
5	
6	
7	

Outer Table			
Frame 1		Frame 6	
Page #	Frame #	Page #	Frame #
0	295	0	854
1		1	
2		2	165
3		3	
4	30	4	
5		5	
6	15	6	
7	62	7	36
8		8	61
9	49	9	
10	51	10	
11		11	
12		12	568
13	14	13	35
14		14	
15		15	

Inner Table					
Frame 62		Frame 51		Frame 35	
Page #	Frame #	Page #	Frame #	Page #	Frame #
0	498	0		0	467
1		1		1	

2	489	2		2	
3	65	3	321	3	88
4		4		4	
5		5		5	
6		6		6	
7	687	7	948	7	32
8		8		8	
9	105	9		9	76
10		10		10	60
11	285	11		11	
12	214	12	716	12	
13		13	497	13	110
14		14		14	
15		15		15	

Answer: a. 3 4 4 5
B. 2456
6870

CSE321 - Operating Systems
Quiz 4
Section __ (Set B)

Date:

Full name: ID:

Total Marks: 15

1. Answer the following:
    a. What registers are used for address protection?
    b. What is physical address space?
    c. Page vs. Frame.
    d. What is PTLR?
    e. Find Effective Access Time for memory access of 110ns, ε = 30ns, α = 94%

Answer: A. Base and limit registers
B. Set of all the physical addresses that can be found in main memory
C. Page in logical memory, frame in physical memory
D. Page table length register, contains the length of page table
E. 140*0.94 + 250*0.06 = 146.6ns

Set B, ID:

2. A process runs in a system with multi level paging and it has a logical address space of 16 bits. In the system page size is 64 Bytes, size of each entry of the page table is 4 Bytes and size of the main memory is 512 KB. In order to fit the pages of the process in the main memory the OS applies a two-level paging technique in outer page number bits of the logical address space until the outer most page table can be allocated in a frame of the main memory.
    a. Illustrate the logical address space of the process including the necessary outer page bits, inner page bits and offset bits of every step with proper mathematical calculations during the paging mechanism of the system described above.
    b. In this system, if the CPU generates logical addresses 23352 and 36758 then map the corresponding physical addresses of these logical addresses.

Necessary page table information is given below

2nd Outer table	
Page #	Frame #
0	8
1	2
2	6
3	

Outer Table			
Frame 2		Frame 6	
Page #	Frame #	Page #	Frame #
0	295	0	854
1		1	
2		2	165
3	89	3	18
4	30	4	
5		5	
6	37	6	
7	62	7	36
8		8	61
9	49	9	
10	510	10	
11		11	
12		12	568
13	351	13	
14		14	
15		15	

Inner Table					
Frame 37		Frame 510		Frame 18	
Page #	Frame #	Page #	Frame #	Page #	Frame #
0	498	0		0	
1		1		1	
2	489	2	29	2	
3	65	3		3	610
4		4		4	
5		5	45	5	
6		6		6	48
7	687	7	948	7	
8		8		8	643
9		9	1051	9	
10		10		10	
11	563	11		11	
12	94	12	716	12	
13		13	497	13	65
14		14		14	124
15		15		15	57

Answer: a. 2 4 4 6
B. 6072
7958

Solve

CSE321 - Operating Systems
Quiz 5
Section __ (Set A)

Date:

Full name: ID:

Total Marks: 15

1. Answer the following questions:
   a. What is demand paging?
   b. Write two disadvantages of demand paging.
   c. What is the principle of least privilege?
   d. What is access matrix?
   e. What is copyright in access matrix?

a) Bringing page to memory only when needed

b) Page fault interrupt, extra hardware support

c) Should be given just enough privilege.

d) Access rights of domain and objects shown as matrix.

e) Copying an accen right within column.

2. In a system, there are **4 frames** in the main memory. In a particular scenario main memory needs to accommodate **20 pages** according to the order of the given reference string.

[1 0 8 5 7 5 6 8 3 1 2 6 0 9 7 2 9 5]

Apply LRU and Optimal page replacement algorithms in order to accommodate the pages in the main memory and find out page hit ratio and page fault ratio of every algorithm.

LRU:

1.	0.	8.	5.	7.	5.	6.	8.	3.	1.	2.	6.	0.	9.	7	2	9	5
1*	1*	1*	1*	7	7	7	7*	3	3	3	3*	0	0	0	0*	0*	5
	0	0	0	0*	0*	6	6	6	6*	2	2	2	2*	7	7	7	7*
		8	8	8	8	8*	8	8	8	8*	6	6	6	6*	2	2	2
			5	5	5	5	5	5*	1	1	1	1*	9	9	9	9	9
					hit		hit									hit	

hit ratio = $\frac{3}{18}$, page fault ratio = $\frac{15}{18}$

Optimal:

1	0	8	5	7	5	6	8	3	1	2	6	0	9	7	2	9	5
1*	1	1	1	1	1	1	1	1	1*	2	2	2	2	2	2*	2*	5
	0*	0*	0*	7*	7	7*	7	7	7	7	7	7	7	7*	7*	7*	7
		8	8	8	8	8	8*	3*	3*	3*	3*	0*	9	9	9	9*	9
			5	5	5*	6	6	6	6	6	6*	6*	6*	6*	6*	6*	6
					hit		hit		hit		hit			hit	hit	hit	

hit ratio = $\frac{7}{18}$, page fault ratio = $\frac{11}{18}$

Solve

CSE321 - Operating Systems
Quiz 5
Section __ (Set B)

Date:

Full name: ID:

Total Marks: 15

1. Answer the following:
   a. What is page fault?
   b. Write two advantages of demand paging.
   c. What is the need-to-know principle?
   d. What is domain regarding protection of OS?
   e. What is ownership right in access matrix?

a) Required page not in memory.

b) Less memory, faster response.

c) At any time, accen only those objects that are currently required.

d) Rings of protection separate functions into domains, with set of accen rights.

e) Adding or removing rights of objects owned by a domain.

2. In a system, there are **4 frames** in the main memory. In a particular scenario main memory needs to accommodate **20 pages** according to the order of the given reference string.

[1 5 8 5 7 1 3 8 9 1 2 6 0 9 7 2 9 4 0 1]

Apply LRU and Optimal page replacement algorithms in order to accommodate the pages in the main memory and find out page hit ratio and page fault ratio of every algorithm.

LRU:

1	5	8	5	7	1	3	8	9	1	2	6	0	9	7	2	9	4
1*	1*	1*	1*	1*	1	1	1	1*	1	1	1	1*	9	9	9	9	9
	5	5	5	5	5	5*	8	8	8	8*	6	6	6	6*	2	2	2
		8	8	8	8*	3	3	3	3*	2	2	2	2*	7	7	7	7*
				7	7	7	7*	9	9	9	9*	0	0	0	0*	0*	4
			hit		hit			hit								hit	

hit ratio = $\frac{4}{18}$, page fault ratio = $\frac{14}{18}$

Optimal:

1	5	8	5	7	1	3	8	9	1	2	6	0	9	7	2	9	4
1*	1*	1	1	1	1	1	1	1	1*	2	2	2	2	2	2*	2*	2
	5	5	5*	5*	5*	3*	3*	9*	9	9	9	9	9	9	9	9*	9
		8*	8*	8	8	8	8*	8*	8*	8*	6*	0*	0*	0*	0*	0*	4
				7	7	7	7	7	7	7	7	7	7	7*	7*	7*	7
					hit		hit		hit					hit	hit	hit	hit

hit ratio = $\frac{8}{18}$, Page fault ratio = $\frac{10}{18}$