

Operating Systems

Examination Sheet

(16:30-16:50PM, January 27, 2011 -- open book)

Student Name: _____

ID: _____

Problem 1 (20 points). Consider the two-dimensional array a like this

```
double a[150][150]
```

Where $a[0][0]$ is at location 300, in a paged memory system with pages of size 300 words. Each word has 4 bytes in length. A small process is in page 0 (locations 0 to 299) for manipulating the matrix; thus, every instruction fetch will be from page 0. For three page frames, how many page faults are generated by the following array-initialization loops (C-language), using LRU replacement, and assuming page frame 1 has the process in it, and the other two are empty initially:

- A). **for** (i = 0; i < 150; i++) Answer: _____
 for (j = 0; j < 150; j++)
 a[i][j] = 0;
- B). **for**(j = 0; j < 150; j++) Answer: _____
 for(i = 0; i < 150; i++)
 a[i][j] = 0;

Problem 2 (35 points). Consider a file currently consisting of 150 blocks numbered from 0 to 149. Assume that the file control block (and the index block, in case of indexed allocation) is already in memory. Calculate how many disk I/O operations are required for contiguous, linked, and indexed (single-level) allocation strategies, if, for one block, the following conditions hold. In the contiguous-allocation case, assume that there is no room to grow in the end, but there is room to grow in the beginning. Assume that the information block to be added is stored in memory. Fill the following table.

	contiguous	linked	indexed (single-level)
The block is added in the beginning.			
The block is added after the block 75			
The block is added in the end.			
The block is removed from beginning.			
The block 35 is removed.			
The block is removed from end.			

Problem 3 (25 points). The beginning of a free space bitmap looks like this after the disk partition is first formatted as :

1000 0000 0000 0000 0000

The first block is used by the root directory. The system always searches for free blocks **starting at the lowest numbered block** using **the contiguous allocation** and **the best-fit strategy**, so after writing file A, which uses 7 blocks, the bitmap looks like this:

1111 1111 1000 0000 0000.

Show the bitmap after each of the following additional actions (continue the table):

NN	ACTION	BITMAP																			
1	Initial state	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
2	File A is written, using 7 blocks	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	
3	File B is written, using 5 blocks																				
4	File A is deleted																				
5	File C is written, using 7 blocks																				
6	File D is written, using 4 blocks																				
7	File C is deleted																				
8	File E is written, using 3 blocks																				
9	File F is written, using 1 block																				
10	File B is deleted																				

Problem 4 (20 points). What are the advantages and disadvantages of making the distributed systems? Divide into advantage, disadvantage and “not important” topics the following distributed system characteristics:

		Advantages	Disadvantages	Not important
1	Resource sharing			
2	Complexity			
3	Openness			
4	Concurrency			
5	Transparency			
6	Security			
7	Fault tolerance			
8	Manageability			
9	Scalability			
10	Free-space Management			
11	Recovery from failure			
12	Deadlock handling			
13	Unpredictability			
14	Portability			
15	Load balancing			
16	Computation speedup			
17	Remote file transfer			
18	Remote login			
19	CPU scheduling			
20	Thrashing			
21	Failure Detection			
22	Routing Strategies			
23	Paging			
24	Demand Paging			
25	Demand Segmentation			

Remarks:

1. Mark the corresponding cell by “*”.
2. You should compare standard (one CPU) and distributed systems. The term “Advantages” means that in distributed systems, the corresponding parameter is changed improving the quality and efficiency of operating systems services. The term “Not important” means that the corresponding parameter has no influence to distributed systems services.
3. To obtain 20 points it is enough to get 20 right answers.