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Curriculum:	80DISA - Information Systems Administration and 80DSEN - Software Engineering		
Subject Code:	OPS120S		
Subject:	Operating Systems 1B		
Date:	2002 – 2nd Examination	Paper:	Theory
Duration:	3 Hours	Marks:	100

Second Examination Question Paper

Lecturer / First examiner: Bernd Kiekebusch

Moderator / Second examiner: Bernd Schulz

This question paper consists of 9 pages (including the front page)

Student Name: _____

Student Number: _____

Instructions

1. Please answer all questions on the question paper. Space has been provided for this purpose.
2. Where the question is a True or False, Yes or No, or Multiple choice, mark the correct answer directly on the question paper with a cross in the provided check box. 0.5 points will be deducted per wrongly answered questions.
3. When answering questions you should be led by the allocation of marks. Do not give too few or too many facts in your answer.
4. There are no books, notes or any other additional aids allowed.

IMPORTANT: **If a question requires as answer an explanation or description, NO marks will be given unless reasonable details or arguments are given in full, readable English sentences. (Key words alone are NOT sufficient.)**

Section A – Multiple Choice Questions

(Mark your choice with an "X" in the appropriate box. One full mark will be given for each correct answer, one half mark will be deducted for each incorrect answer. If neither "True" nor "False" are marked, zero points will be given.)

1. What are responsibilities of the File Manager in an Operating System?

(6 points)

True	False	
☐	☐	Format a disk, when requested
☐	☐	Keep track of where each file is stored
☐	☐	Encrypt secure files
☐	☐	Manage file access permissions
☐	☐	The File Manager uses Volume labels to keep track of available storage media
☐	☐	A main function of the File Manager is regular scheduled backups for data

2. RAID Systems

(4 points)

True	False	
☐	☐	The parity information must be on the same disk as the data
☐	☐	If a disk with data in a RAID system fails, the parity information can be used to re-create the original data
☐	☐	8-track tapes use parity information and therefore are suitable for RAID systems
☐	☐	Striping requires less disk space than mirroring for the same amount of data

3. File Manager

(4 points)

True	False	
☐	☐	The File Manager must keep track where each file is stored
☐	☐	The File Manager automatically compresses large files

☐	☐	The File manager treats database files as a collection of single, separate files
☐	☐	For the File Manager directories are files with special content

4. Compression

(4 points)

True	False	
☐	☐	Compression permanently discards data that are not important
☐	☐	Compression writes data bits closer to each other on the physical disk in order to save space
☐	☐	Front-end compression is a special technique for indexing
☐	☐	In general, compression makes data access faster

5. Access Control

(4 points)

True	False	
☐	☐	The Access Control List can be derived from the Access Control Matrix
☐	☐	The Access Control List keeps track of user rights on files
☐	☐	The Access Control List stores the lockwords
☐	☐	Using a Capability List usually gives better performance than using an Access Control matrix

6. Networking

(4 points)

True	False	
☐	☐	A router is a device that uses logical addresses to direct network traffic
☐	☐	A hybrid network topology is always one where at least two different network protocols are installed
☐	☐	The routing information protocol calculates the distance between two hosts by computing the physical length of the transmission line.
☐	☐	All hosts on a network have a hardware installed physical network Address

7. MS DOS or PC DOS Operating systems

(10 points)

True	False	
☐	☐	All DOS commands are implemented as separate executable files
☐	☐	DOS was designed for computers with 1Mb memory
☐	☐	With the FDISK command, DOS can be de-activated, so it can not start up
☐	☐	The BIOS provides basic device drivers for keyboard and monitor
☐	☐	DOS recognises files with extension .COM as executable files
☐	☐	DOS was designed for IBM's RISC processor
☐	☐	The original DOS left some part of physical memory unused
☐	☐	In DOS, each subdirectory has an entry in the MFD (master file directory)
☐	☐	The root directory is for system use only and not accessible to users
☐	☐	The user interface for DOS is text based

8. WINDOWS Operating systems

(4 points)

True	False	
☐	☐	Windows NT was developed for portability on different types of Processors
☐	☐	Windows NT/2000 is a preemptive, multitasking, multithreaded operating system
☐	☐	Windows 2000 can only use file systems in Fat or NTFS format
☐	☐	Windows NT/2000 is a scalable for multi-processor systems

Section B – Question and Answer

(Write your answers into the space provided)

9. What is the difference between a Volume Descriptor and a Volume Table of Contents (VTOC, also called MFD). Explain in detail. **(4 points)**

10. Routers are used to direct network traffic (messages).
    a) Which type of addresses are used primarily by routers to determine the path to send a message **(1 point)**

    b) Explain the purpose and function of a Routing Protocol **(3 points)**

    c) Routers also use network (routed) protocols. Explain what is different from a routing protocol **(3 points)**

11. a) Describe how a token ring topology handles the possibility of collision of signals. **(3 points)**

b) Describe what happens when a collision of signals happens in an Ethernet network. **(3 points)**

12. a) What happens in a simple ring topology, if one node (host) fails. Explain **(2 points)**

b) Design a modification to this topology that overcomes the problem of one failing node (host). Explain, how it will work. **(3 points)**

13. An index has to contain the key values of the data (length depending on the choice of keys) and a storage address for the record, where the data are. Assume an application, where:
    - Block size is 2048 (2k) bytes, of which 48 bytes are overhead
    - Record size must fit into the block's free space
    - Each node of the index has maximum possible size to fit into a block
    - The index is populated with 50% free space in each node
    - Each storage address is 4 bytes long
    - Each key value is 16 bytes long
    - The index is perfectly balanced and exactly 50% full

    a) How many data records are referenced by each node? **(4 points)**

    b) How many nodes are in the 2 top levels of a 3-level index? **(3 points)**

    c) How many nodes are in the bottom level of a 3-level index? **(3 points)**

    d) How many data records are referenced by this index when all nodes are 50% full? **(3 points)**

14. Why is the tree structure of subdirectories advantageous for storing data files? Give at least two reasons and explain. **(5 points)**

15. The DOS operating system restricts file names to the "8.3" format. However, Windows 95/98/ME, which uses the same FAT file system, allows up to 100 character long filenames with multiple embedded spaces and periods. Explain, how both options are accommodated in the same file system. **(3 points)**

16. The device manager is optimised for transfer of data in blocks (pages), where the fixed block length is pre-determined by hardware constraints. Applications tend to use records of smaller-than-block size depending on logical needs. Describe how I/O can be made optimal (fast) under these circumstances and explain why your proposed solution improves performance. **(5 points)**

17. What does a hashing algorithm do? Explain in detail. **(4 points)**

18. What is the difference between contiguous and non-contiguous storage of data? Explain and give at least one advantage for each method **(4 points)**

19. Explain how the PATH works in DOS, and what effect it has on the execution of DOS commands. **(4 points)**