Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Section:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**University of Maryland University College**

**ITEC 625 Final Examination**

**The Exam is open book/notes, but individual, not to be shared**. Save the file with your answers as an MS Word file (please **label** the file ITEC625-Final-YourLastName.doc), and post it in your Assignments folder before the deadline. Please do keep the questions/instructions and points for each question in this Word document with your answers.

**Part I. Multiple-choice questions – 50 questions, 1 point each**

For each question, choose the best alternative and put the letter corresponding to your answer choice in the table on this **cover sheet**. For example, if your answer to Q1 is A, then type A in the box underneath question 1. Please choose ONE answer for each question.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Question | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| Answer |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Question | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 |
| Answer |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Question | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 |
| Answer |  |  |  |  |  |  |  |  |  |  |

**ATTENTION: Please notice that the exam has two parts, Part I and II. Part I consists of 50 multiple choice questions, while Part II 10 short-answer questions.**

**Part I. Multiple-choice questions – 50 questions, 1 point each**

1. Which of the following is not a common function of an I/O disk controller?
	1. **The I/O disk controller manages main memory during the transfer.**
	2. The I/O disk controller recognizes messages addressed to it and accepts commands from the CPU.
	3. The I/O disk controller has interrupt capability, which it uses to notify the CPU when the transfer is complete.
	4. The I/O disk controller provides a buffer where the data from memory can be held until it can be transferred to the disk.
2. Storage not immediately available to the CPU is referred to as
	1. cloud storage.
	2. off-line storage.
	3. network storage.
	4. **secondary storage**.
3. In a disk drive where the drive motor turns at constant angular velocity, which is true of the linear velocity?
	1. inner tracks move the fastest
	2. **outer racks move the fastest**
	3. middle tracks move the fastest
	4. all tracks move at the same speed
4. In a mirrored array with 4 disks, each of the disks stores exactly the same data. The access time for a multiblock read is reduced by a factor of about \_\_\_\_\_\_.
	1. two
	2. **four**
	3. eight
	4. sixteen
5. The technique used for storage and retrieval in an LTO formatted data cartridge is called
	1. a) data torrent.
	2. b) LTO tasking.
	3. c) data continuity.
	4. **d) data streaming.**
6. Displays that use 256 (Red) × 256 (Green) × 256 (Blue) different colors on the screen is sometimes described as a
	1. **true color system.**
	2. virtual color system.
	3. ultra high density system.
	4. high density color system.
7. An International standard maintained by a non-profit consortium to render 2-D and 3-D objects is known as
	1. **OpenGL.**
	2. DirectX.
	3. ActiveX.
	4. OpenSource.
8. Which display technology consists of a thin display panel that contains red, green, and blue LEDs for each pixel with transistors for each LED that generate electrical current to light the LED?
	1. CRT
	2. LCD
	3. FED
	4. **OLED**
9. An important difference between the I/O requirements of keyboards and disk drives is that
	1. keyboard input is fast while disk drives are slow.
	2. keyboards require constant monitoring, while disk drives do not.
	3. disk drives have I/O controllers and keyboards do not have I/O controllers.
	4. **disk data is always transferred in blocks, never as individual bytes as with the keyboard.**
10. The method of transferring data one word at a time from the CPU to a device is called
11. polling.
12. **programmed I/O.**
13. vectored interrupt.
14. direct memory access.
15. Since many interrupts exist to support I/O devices, most of the interrupt handling programs are also known as
	1. **device drivers.**
	2. device handlers.
	3. peripheral handlers.
	4. peripheral controllers.
16. Which of the following is not a function of how interrupts are used?
	1. A completion signal
	2. An abnormal event indicator
	3. A means of allocating CPU time
	4. **A way of buffering large amounts of data**
17. Events related to problems or special conditions within the computer system itself, like divide by zero, or attempting to execute a nonexistent op code, are called
	1. irregular events.
	2. unusual events.
	3. **abnormal events.**
	4. anomalous events.
18. Instructions that are intended for use by an operating system program, but not by an application program, are called
19. control instructions
20. limited instructions
21. prevalent instructions
22. **privileged instructions**
23. When the device generating the interrupt request identifies its address as part of the interrupt, it is called
	1. polling interrupt.
	2. discrete interrupt.
	3. **vectored interrupt.**
	4. monitoring interrupt.
24. Which of the following is not one of the three primary conditions for direct memory access to take place?
	1. **The I/O device must have an internal buffer.**
	2. There must be a method to connect together the I/O interface and memory.
	3. There must be a means to avoid conflict between the CPU and the I/O controller.
	4. The I/O controller associated with the particular device must be capable of reading and writing to memory.
25. When a key is pressed on the keyboard, a binary code called a(n) \_\_\_\_\_\_ is sent to the controller.
	1. octal code
	2. **scan code**
	3. check code
	4. ASCII code
26. Protocols that describe a computer’s communication with the physical layer network are called
	1. LAN access control protocols
	2. shared access control protocols
	3. **medium access control protocols**
	4. medium admission control protocols
27. Which of the following use computer-based operating systems?
	1. Mobile phones
	2. Business systems
	3. E-readers and notebooks
	4. **All of the above**
28. Most modern operating systems provide some capability for combining computer commands into pseudo-programs, commonly called
	1. API scripts.
	2. **shell scripts.**
	3. power scripts.
	4. internal scripts.
29. Which operating system function is responsible for providing a consistent view of files across different I/O devices?
	1. Memory management
	2. The file management system
	3. **The input/output control system**
	4. Network management, communication support, and communication interfaces
30. Which operating system function optimizes the completion of I/O tasks by using algorithms that may reorder the requests for efficient disk access?
	1. **Scheduling and dispatching**
	2. Secondary storage management
	3. Support for system administration
	4. System protection management and security
31. Which operating system function limits the execution of a process to a sandbox?
	1. Scheduling and dispatching
	2. Secondary storage management
	3. **Support for system administration**
	4. System protection management and security
32. Which operating system function manages system configuration and setting group configuration policies?
	1. Scheduling and dispatching
	2. Secondary storage management
	3. Support for system administration
	4. **System protection management and security**
33. The CPU may be switched rapidly between different programs, executing several instructions from each, using a periodic clock-generated interrupt. What is that technique called?
34. threading
35. **time-slicing**
36. execution switching
37. nonpreemptive switching
38. The operating system configuration of UNIX is an example of a
	1. layered configuration.
	2. monolithic configuration.
	3. **hierarchical configuration.**
	4. microkernel configuration.
39. The predominant operating system type in current use are \_\_\_\_\_\_\_\_\_\_\_\_\_ multitasking systems.
	1. mobile
	2. real-time
	3. embedded
	4. **single user**
40. Command languages are also referred to as
	1. APIs.
	2. procedures.
	3. scripting languages.
	4. **all of the above.**
41. Some systems hide the user interface and use a \_\_\_\_\_\_\_\_\_\_\_\_\_ model to serve as the interface for applications.
	1. **CLI**
	2. GUI
	3. Web browser
	4. Powershell Window
42. Which user service is responsible for handling the physical manipulation of the files and to translate between logical and physical file representations?
	1. **File Management System**
	2. Disk and other I/O Device
	3. Security and Data Integrity Protection
	4. System Status Information and User Administration
43. Which user service is responsible for determining the amount of available disk space?
	1. File Management System
	2. **Disk and other I/O Device Services**
	3. Security and Data Integrity Protection
	4. System Status Information and User Administration
44. Which user service allows the user to change the user's password?
	1. Program Execution
	2. File Management System
	3. **Security and Data Integrity Protection**
	4. System Status Information and User Administration
45. Keyword operands are sometimes known as
	1. **switches.**
	2. mutations.
	3. amendments.
	4. command list parameters.
46. Which type of program is well suited for routine transaction processing applications, such as credit card billing and payroll?
	1. **Batch programs**
	2. Network programs
	3. Complier programs
	4. Interactive programs
47. Early implementation of gesture- and voice-based technology was designed primarily for
	1. thin clients.
	2. set-top boxes.
	3. computer games.
	4. **high-end workstations.**
48. Which of the following is NOT an important feature of a command language?
	1. Branch and loop
	2. Print messages on the screen
	3. Notifying the system administrator
	4. Assign and change the value of a variable
49. Assigning system resources such as memory through \_\_\_\_\_\_\_\_\_\_\_\_\_ assures that a program cannot overwrite memory in use by a different program.
	1. the API
	2. powershell
	3. a script program
	4. a command shell
50. Which of the following is a portable script language?
	1. C#
	2. **Python**
	3. Java
	4. XML
51. What type of data file consists of information about other files?
	1. Video
	2. Database
	3. **Directory**
	4. Source code
52. The \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is the smallest unit that the file management system can store or retrieve in a single read or write operation.
	1. sector
	2. chunk
	3. **cluster**
	4. byte
53. If the allocation unit size is too small,
54. file access is slower.
55. there is less overhead to track each allocation unit.
56. there is more unused space at the end of most allocation units.
57. All of the above
58. Most user commands to the operating system are actually requests to the \_\_\_\_\_\_\_\_ manager.
59. I/O
60. file
61. memory
62. processor
63. A \_\_\_\_\_\_\_\_\_\_\_\_ occurs when two different records calculate to the same hash number (logical record number).
	1. crash
	2. impact
	3. conflict
	4. collision
64. The Universal Data Format (UDF) supports High Definition and Blu-Ray DVD formats. UDF directory format is \_\_\_\_\_\_\_\_\_\_\_\_\_\_.
	1. flat
	2. ad hoc
	3. matrix
	4. hierarchical
65. The file system must maintain a directory structure for each device. In most cases, the directory for each device is stored on the device itself. In many computer systems, each file system is called a
	1. disk.
	2. volume.
	3. directory.
	4. partition.
66. To increase security, the critical parts of the operating system will execute in a protected mode while other programs will execute in \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ mode.
	1. **user**
	2. global
	3. shared
	4. isolated
67. \_\_\_\_\_\_\_\_\_\_\_\_\_ systems will limit the time that the program remains in the running state to a fixed length of time corresponding to one or more quanta.
	1. Multiuser
	2. **Preemptive**
	3. Cooperating
	4. Nonpreemptive
68. When memory is partitioned into fixed spaces, \_\_\_\_\_\_\_\_\_\_\_\_ fragmentation is likely to occur.
	1. a) outer
	2. b) central
	3. c) **internal**
	4. d) external
69. During execution, programs exhibit a tendency to stay within small areas of memory during any given period of time. This property is called the
	1. **locality of reference.**
	2. small area of execution.
	3. residual execution property.
	4. neighboring instruction concept.
70. Application program interface services allow a program to access network services. Some network operating systems also provide access to services on remote machines that might not be available locally. These services are called
	1. server-client calls (SCCs).
	2. object procedure calls (OPCs).
	3. remote procedure calls (RPCs).
	4. network method calls (NMCs).

**Part II. Essay questions – 10 questions, 5 points each, 50 points all together**

Answer the questions succinctly and clearly, explain your answer, and show your work. Answers, even if right but without an explanation, will get no credit. On the other hand, partial credit will be given for the right steps shown to solve a problem, even the final result is not correct. The explanations need to be brief, but complete, logical, and to the point. Do **not** quote anybody else; use your own words and calculations.

1. Suppose that the keyboard device stored keystrokes in a buffer until a valid command is recognized. Describe what software component is needed and how it notifies the operating system to process the command. (Two or three sentences should be adequate to answer this question)
2. Consider the steps required to read a record from a file stored on a disk and write it to memory. Outline the major sequence of I/O events that must occur to make this possible. (There are three major steps)

1) Four pieces of data are sent to disk controller:1) the location of the block in memory; 2) the location where the data is to be stored on disk; 3) the size of the block 4) and the direction of transfer: Write.2) The I/O service program sends a “ready” message to the disk controller and the DMA transfer process takes place

1. How is a hardware failure such as memory fault different than an interrupt from the hard disk controller signaling that a data transfer has completed? (Three or four sentences are sufficient)
2. Suppose that all programs in a particular CPU are given 40 clock cycles to process before getting swapped out for another program. Suppose also, that it takes 2 CPU clock cycles to swap out the process control block (PCB) for a particular program and restore the next program’s PCB. What percent of the CPU clock cycles are used for processing 100 programs? (Hint: calculate: Program clock cycles / (Swap clock cycles + Program clock cycles)). Show your work and how you arrived at the solution.
3. For a display of 1920 pixels by 1080 pixels at 16 bits per pixel how much memory, in megabytes, is needed to store the image?

Sol: 1920 \* 1080 = 2,073,600 pixels 2,073,600 pixels \* 2bytes/pixel = 4,147,200 bytes Convert to megabytes: 4,147,200 bytes (1 MB / 1048576 bytes) = 3.955MB Where 1 MB = 2^20 B = 1,048,576 Section 10.6 Displays

1. What is the average rotational latency of a hard drive rotating at 7,200 RPM or 120 revolutions per second? (Give your answer in milliseconds)

Avg. latency time = ½ X 1/rotation speed

Change rotation speed to revolution per sec: 7200rev/min X 1 min/60 sec) 120 rev/sec

Avg. latency time = ½ X 1/ 120rev/sec = 0.004167sec = 4.167ms

Section 10.3 magnetic disks

1. Answer both part a and b.
	1. What is the responsibility of the dispatcher during a context-switch?
	2. There are two levels of scheduling. One level of scheduling determines which jobs will be admitted to the system and in what order. What does the other level of scheduling do?
2. What system architecture is typically used to support high availability and scalability and how (Hint: Group Project. Please explain how the architecture supports high availability and scalability)?
3. How many 512 byte blocks are required to store a 3.2MB file?
4. Perform the Round-Robin dispatch algorithm, with time quantum equal to 300 milliseconds, on the job queue and calculate:

Job 1 arrives at time 0 and needs 500 milliseconds to complete.

Job 2 arrives at time 300 milliseconds and needs 400 milliseconds to complete.

Job 3 arrives at time 400 milliseconds and needs 200 milliseconds to complete.

Job 4 arrives at time 400 milliseconds and needs 500 milliseconds to complete.

1. The average wait time. (Hint: average the number milliseconds each job was in a wait state)
2. Average turn-around-time. (Hint: for each job, count the number of milliseconds from arrival to completion and average)