1. Which of the following statements is *True*?

a. In an *array*, all the elements are of the same type
b. In a *vector*, elements may be of differing types
c. In an *array*, the value of the element is used as the *key*
d. In a *hashed* storage structure, the time to find a particular element is always O(1)
e. The minimum amount of work needed to evaluate a complete polynomial is $O(N^2)$

Answer: a

2. In an unordered data set, the time complexity to complete an *Exchange Sort* is

a. O(1)
b. O(logN)
c. O(N)
d. O(NlogN)
e. $O(N^2)$.

Answer: e

3. In sorting a deck of playing cards into order, the dealer compares each card with every card already in the ordered part of the deck. The complexity of this process is:

a. A constant
b. O(logN)
c. O(N)
d. O(NlogN)
e. $O(N^2)$

Answer: e

4. Two polynomials are to be stored in a sparse format (not using hashing). An algorithm is designed to be able to add the two polynomials. The time complexity of this algorithm will be:

a. A constant
b. O(logN)
c. O(N)
d. O(NlogN)
e. $O(N^2)$

Answer: c

5. Retrieving a data item from a *hashing* structure requires:

a. The application of a set of hashing functions
b. A linear search through a bucket
c. A search of all the buckets
d. A knowledge of how many collisions occurred in storing the item
e. A way of marking deleted data items

Answer: a

6. A sparse array can be stored as a set of values and keys indicating the position of each non-zero in the array; or it can be stored as an array with all the zeros. If the keys are integers and the values are integers, what is the minimum percentage of the array that should be zero to make it worth using a sparse structure (in terms of the memory usage)?

a. 30%
b. 40%
c. 50%
d. 60%
e. 70%

Answer: c

7. When a *hashed storage scheme* is used, the order in which elements appear in the storage array depends on:

a. The order in which they were received
b. The size of the storage array
c. The number of data items needing to be stored
d. The hashing functions used
e. The type of data being stored

Answer: d

8. Which of the following is NOT needed to decode a *two dimensional array*?

a. The number of columns or rows
b. The length of each column or row
c. Whether it is stored by columns or rows
d. The type of each element
e. The location of the first non-zero value.

Answer: e

9. At the end of the third pass of the Quicksort algorithm, under ideal conditions, how many items are sorted into their correct locations?

a. 1
b. 3
c. 5
d. 7
e. 9

Answer: d

10. The worst case time complexity to complete an Exchange sort is

a. O(1)
b. O(logN)
c. O(N)
d. O(NlogN)
e. $O(N^2)$.

Answer: e

11. Under what condition is it not worth sorting data before searching?

a. The number of searches to be performed is equal to Log_2M
b. The number of searches to be performed is greater than Log_2M
c. The number of searches to be performed is less than Log_2M
d. The data should always be sorted before searching
e. it is never worth sorting the data before searching

Answer: c

12. The minimum time complexity of evaluating a polynomial stored without taking account of sparsity is:

a. O(1)
b. $O(log_2N)$
c. O(N)
d. $O(Nlog_2N)$
e. $O(N^2)$

Answer: c

13. The ratio of the average sort time of a *quicksort* to that of an *exchange sort* is:

a. N

b. LogN/N
c. $logN/N^2$
d. N/LogN
e. N^2/LogN

Answer: b

14. In a system using bucket hashing, how many hashing functions might be needed to map data into an array M long?

a. 1
b. M/2
c. M
d. 2M
e. It depends on the number of data items.

Answer: a

15. In an unordered data set, the time to find N items is:

a. A constant
b. O(logN)
c. O(N)
d. O(NlogN)
e. $O(N^2)$

Answer: e

16. An exchange sort is to operate on a data set of N items which is already ordered. How many comparisons need to be executed before the algorithm will terminate?

a. N
b. N-1
c. N(N-1)/2
d. N(N+1)/2
e. N^2

Answer: b

17. In a quicksort, the time complexity of placing a single item is

a. O(1)
b. O(logN)
c. O(N)

d. O(NlogN)
e. $O(N^2)$

Answer: b

18. Which of the following statements is FALSE?

a. Storing data can never be faster than retrieving it
b. The *quicksort* algorithm is always faster than an *exchange sort*
c. Real numbers are usually stored by exponent and mantissa
d. In a hashed data structure the maximum number of collisions is equal to the number of storage locations
e. An item in an array can be directly accessed by specifying its index.

Answer: b

18. The ratio of the average sort time of an *exchange sort* to that of a *quicksort* is:

a. N
b. LogN/N
c. $logN/N^2$
d. N/LogN
e. $N^2/LogN$

Answer: d

20. A *Hashing Scheme* for storing data is often used when

a. The data cannot be sorted
b. The data is of different types
c. Collisions are likely to occur
d. Only a small piece of a potentially large data set is likely to be stored
e. Data arrives in random order.

Answer: d

21. The implementation of a *Non-Vectored Interrupt System*

a. Reduces the memory requirements for handling interrupts
b. Removes the need for an interrupt service routine
c. Speeds up the process of polling interfaces
d. Provides a mechanism for updating the Program Counter in the CPU

e. Creates a software priority system.

Answer: e

22. The *Device Data Register*:

a. Provides a mechanism for enabling interrupts
b. Removes the need for an interrupt mechanism
c. Contains the address of a service routine
d. Provides a temporary location for data moving to and from the bus
e. Is only necessary for low speed devices.

Answer: d

23. How many **signal** wires are needed in a circuit to implement a *full duplex communications* system?

a. 1
b. 2
c. 3
d. 4
e. 5

Answer : b

24. In a implementing a START/STOP protocol over a full *RS-232* connection, the minimal overhead incurred as a percentage of an 8 bit character transmission is

a. 0%
b. 12.5%
c. 25%
d. 37.5%
e. 50%

Answer: c

25. A *Timing Problem* can occur between a printer and a cpu because

f. the connection between them may only be a serial line
a. the cpu can output characters much faster than the printer can print them
b. the printer may not be switched on
c. the printer cannot send information back to the cpu

d. data has to be converted from parallel to serial and back again.

Answer: b

26. Which of the following is NOT usually provided by a computer bus?

f. Data
a. Address
b. Control
c. Power
d. They are all provided

Answer: e

27. In a *vectored interrupt* system, the action of the interface when an *interrupt acknowledge* signal is received is:

a. Transmit an interrupt set signal
b. Transmit an interrupt set signal when it is ready to send or receive data
c. Place the service routine address on the data lines
d. Place the service routine address on the data lines if it has transmitted interrupt set
e. Latch the data on the data lines

Answer: d

28. *Polled Interrupts* is a system by which:

a. An interface can interrupt the cpu
b. The cpu can move information to or from an interface without using interrupts
c. A C++ program can read or write data
d. The cpu can determine which interface caused an interrupt
e. An interface can transfer control to an Interrupt Service Routine.

Answer: d

29. An *Interrupt Service Routine* is best described as:

a. A timed maintenance check on a device
b. The routine which checks the interrupt status at the end of a “Fetch and Execute” cycle
c. A software routine which is designed to move data to or from an interface
d. A routine used to enable interrupts on a device
e. None of the above

Answer: c

30. *Full Duplex* is a system in which

a. Each end of a communications system takes its turn in transmitting data
b. All the bits of an ASCII code are transmitted
c. A single device can perform both input and output.
d. Communication can take place in both directions at the same time
e. Only two wires are used to transmit data.

Answer: d

31. In transmitting a data string in a serial format, which of the following is NOT needed for reliable reception?

a. The start point of the data string
b. The transmission speed
c. The character encoding being used (ASCII or something else)
d. The number of bits in the data string
e. They are all needed.

Answer: c

32. *RS-232* was designed to

a. simplify serial communications
b. allow serial communications without the need for control lines
c. reduce the number of wires needed for serial communications
d. connect computers together
e. provide reliable serial communications between computers and modems.

Answer: e

33. The *Interrupt* signal would usually be part of which section of a computer bus?

a. Data
b. Address
c. Control
d. Power
e. None of the above – it is separate from the bus

Answer: c

34. In an RS-232 system, *Request To Send* means

a. The link between the modem and the computer is ON
b. The link between the computer and the modem is ON
c. The computer wants to send a character to the modem
d. The modem is ready to receive a character from the computer
e. None of the above.

Answer: c

35. Which of the following best describes an *interrupt*?

a. A method for checking the Device Status Register of an interface
b. A hardware initiated subroutine call
c. A method of indicating “Device Busy” to the cpu
d. A control wire in the bus
e. A method of moving data to a printer.

Answer: b

36. A *device interface* is

a. A set of commands that may be used to control a device
b. The view of the device presented to a user
c. A piece of hardware which controls the movement of data between the cpu and a physical device
d. Hardware which always interrupts when it is not busy
e. An extension to the cpu architecture to handle peripheral devices..

Answer: c

37. In an RS-232 system, *Data Set Ready* means

a. The link between the modem and the computer is ON
b. The link between the computer and the modem is ON
c. The computer wants to send a character to the modem
d. The modem is ready to receive a character from the computer
e. None of the above.

Answer: a

38. A *Stop Bit* is defined as

a. The last bit in a string being sent over a serial connection
b. A zero level lasting for one bit after the system has been in an idle state
c. A bit period set at a value of 1
d. A bit used to check parity in a serial string
e. The most significant bit in a byte.

Answer: c

39. In a full *RS-232* connection, the number of signals is:

a. 3
b. 4
c. 8
d. 9
e. 25

Answer – e

40. The overhead in the transmission of a byte using a start bit and 2 stop bits is approximately

a. 0%
b. 11%
c. 20%
d. 27%
e. More than 30%

Answer: d

41. *Programmed Input and Output* is a system by which:

a. An interface can interrupt the cpu
b. The cpu can move information to or from an interface without using interrupts
c. A C++ program can read or write data
d. The cpu can determine which interface caused an interrupt
e. An interface can transfer control to an Interrupt Service Routine.

Answer: b

42. *Interrupt Priority* in a polled interrupt system is created by

a. The sequence in which device interfaces are checked in the interrupt service routine
b. The location of the interface on the interrupt acknowledge line
c. The time at which the interrupt is received
d. The address of the interrupt service routine
e. The importance of the interface interrupting.

Answer: a

43. A *maskable interrupt* is one which

a. Cannot be turned off under any circumstances
b. Is automatically turned off if a high priority device interrupts
c. Is not used in a polled interrupt system
d. Can be turned off globally to avoid spurious interrupts
e. Determines the priority of a device.

Answer: d

44 The *Device Status Register* is used to

a. Store data before it is placed on the bus
b. Store the address of the Interrupt Service Routine
c. Convert signals from parallel to serial
d. Provide control information to both the cpu and the interface
e. Remove the need for a BUSY signal

Answer: d

45. The *seek time* of a hard disk is:

a. The time taken for the wanted sector to reach the head
b. The time taken to read a sector from the disk to the interface
c. The time taken to find the required byte once a sector has been acquired
d. The time taken to move the head to the correct track
e. The time taken to read the timing track.

Answer: d

46. The access time of an optical disk is longer than that of a magnetic disk because

a. The head flying height is greater
b. The recording density is lower
c. The head mass is much greater

d. Data is not recorded over several concentric tracks
e. The optical disk is faster than a magnetic disk.

Answer (c)

47. Block devices are peripherals which

a. Transfer one or more characters at a time
b. Require a memory buffer to function
c. Need direct access to the CPU
d. Naturally transfer data in large blocks
e. Prevent the CPU from accessing the bus.

Answer (d)

48. The job of a Bus Arbitration system is to

a. Determine which device has interrupted
b. Remove the CPU from the bus
c. Move data between devices and memory
d. Decide which device should have access to the bus next
e. Decide which device should have control of the bus next.

Answer (e)

49. Which of the following is NOT part of the addressing scheme to find data on a magnetic disk?

a. Sector Number
b. Block Number
c. Track Number
d. Surface Number
e. Platter Number

Answer (b)

50. *Direct Memory Access* is a system which

a. Allows the CPU to directly access the memory
b. Removes the CPU from data transfers between memory and a device
c. Requires the CPU to move each byte of data to memory
d. Removes the need for a Bus Request signal
e. Removes the need for interrupts.

Answer (b)

51. Which of the following statements is TRUE?

a. All optical drives are read only
b. All optical drives are write once
c. The rotational delay is the time taken for the wanted sector to reach the head
d. Data on a hard magnetic disk are recorded on a spiral track
e. The timing track is used to determine the rotation speed of a disk.

Answer: c

52. Saturation Recording is a process in which

a. Audio information is stored on a magnetic tape
b. An analog signal is converted into a digital form
c. Only two states are stored in a magnetic medium
d. The signal read back is the differential of the signal stored
e. Data is read back in digital form.

Answer (c)

53. A Floppy Disk rotates more slowly than a Hard Disk because

a. It is a removable medium
b. The data is more compressed
c. It uses less energy
d. The head is in contact with the disk
e. The interface cannot handle high data rates.

Answer (d)

54. The access time of an optical disk is longer than that of a magnetic disk because

a. The head flying height is greater
b. The recording density is lower
c. The head mass is much greater
d. Data is not recorded over several concentric tracks
e. The optical disk is faster than a magnetic disk.

Answer (c)

55. Which of the following is a *control line* needed for a device to become *bus master*?

a. The Interrupt Request
b. The Clock
c. The Data Set Ready
d. The Bus Request
e. The Request to Send

Answer: d

56. *Ampere's Law* states that

a. A changing magnetic field will generate a voltage in a coil
b. A current in a conductor will generate a magnetic field
c. A magnetic material placed in a magnetic field will store the state of the field
d. Movement is needed to store information in a magnetic system
e. A changing magnetic field will erase data stored in a magnetic material.

Answer (b)

57. The data rate on an Accelis tape drive is about

a. 1 MB/second
b. 10 MB/second
c. 20 MB/second
d. 50 MB/second
e. 100 MB/second

Answer (c)

58. Timing information is needed on a disk to

a. Determine the starting point of a sector
b. Determine the density of the data recorded on the disk
c. Determine the clock speed used to record the data
d. Synchronize the disk and the interface
e. Check the rotational speed of the disk.

Answer (a)

59. Which of the following does not apply to a magnetic tape?

a. One-dimensional structure
b. Sequential addressing
c. Access time is independent of the position of the data on the tape
d. A tape must be mounted before it can be used
e. The data on a tape will gradually decay with time.

Answer (c)

60. The access time of an optical disk is longer than that of a magnetic disk because

a. The head flying height is greater
b. The recording density is lower
c. The head mass is much greater
d. Data is not recorded over several concentric tracks
e. The optical disk is faster than a magnetic disk.

Answer (c)

61 The time taken to read an entire track of data on a 3.5 inch Floppy Disk is approximately

a. 400 millisecond
b. 200 milliseconds
c. 100 milliseconds
d. 50 milliseconds
e. 20 milliseconds

Answer (b)

62. Which of the following is NOT part of the specification for a bulk memory system?

a. Non-volatile
b. Large
c. Low cost
d. Read only
e. None of the above

Answer (d)

63. The main function of an arbitration algorithm is to

a. Determine the sequence in which potential masters get control of the bus
b. Ensure that the highest priority device always gets the bus
c. Ensure that the bus is always released when a high priority devices needs it
d. Avoid the use of a “daisy chain” arbitration scheme
e. Simplify the design of the interface logic.

Answer a

64. The addresses of files on a disk are usually kept in:

a. Main memory
b. The directory
c. The Read Only Memory
d. The disk controller
e. The cpu cache

Answer: b

65. In a linked list file storage scheme on a disk, the effect of fragmenting is

a. to possibly lose part of a file
b. to break a link in the list

c. to reduce the amount of usable storage space on the disk
d. to limit the size of the directory
e. to increase the time to access a file.

Answer e

66. The Head Control on a magnetic disk is used to:

a. Move the head radially
b. Ensure that the head does not contact the disk
c. Process the data being read off the disk
d. Move the head peripherally
e. Rotate the disk.

Answer: a

67. Sector Interleaving is used to

a. Use the disk more efficiently
b. Minimize the amount of head movement
c. Match the data transfer rate between the disk and interface
d. Overcome the need for a fixed size directory
e. Reduce the buffer size needed on the interface.

Answer c

68. The main difference between a *fully interlocked* and a *non-interlocked* asynchronous protocol is:

a. The fully interlocked protocol requires a Slave Synchronization Signal
b. The non-interlocked protocol uses only the de-activation edges of signals
c. Only the fully interlocked protocol uses “cause-and-effect” arrows to describe its operation
d. The fully interlocked protocol uses activation and de-activation of signals to transmit information
e. The non-interlocked protocol requires a clock signal.

Answer d

69. Which of the following is a TRUE statement?

a. Sector interleaving is an approach to match the data transfer speeds of the disk and the interface
b. Linked list structures cannot be used on a magnetic tape

c. The amount of data stored on a track depends on its radius
d. The head on a floppy disk flies to prevent erasing the data
e. Disk drives usually transfer data one byte at a time.

Answer: a

70. In the arbitration bus, the Bus Release signal is used to

a. signal that the bus is free and available for address and data
b. the bus is available at any priority level
c. the bus is currently busy
d. the address lines are currently in use
e. indicate that a high priority device has requested the bus.

Answer e

71. A Tristate gate is used to

a. Implement logic systems which have three values (-1, 0, 1)
b. Drive three lines simultaneously
c. Provide an output which enables a control line on the bus
d. Send a Bus Request signal while placing data on the bus
e. Allow a master to control the write access of a slave to the address and data lines.

Answer e

72. In a sequential file storage system on a disk

a. the directory limits the number of files that can be stored
b. no file can be larger than a single track
c. finding a file does not involve reading the directory
d. the directory is only stored in the computer RAM
e. erasing a file is impossible.

Answer a

73. A Timing Track exists on a disk surface to

a. Locate the beginning of each sector
b. Determine when the disk is rotating at the correct speed
c. Control the rate at which data is read from a disk
d. Minimize the amount of head movement
e. Avoid the need for a clock signal in the interface logic.

Answer: a

74. In any bus, a read operation takes longer than a write because

a. the master has to wait for the slave to get the data
b. the transitive delay on the bus is longer for a read
c. more control signals need to be set for a read
d. the slave has to wait for the address lines to stabilize
e. it does not take longer.

Answer a

75. In a fairness based arbitration scheme

a. All potential masters have the same priority
b. The highest priority potential master in the queue always gets the bus first
c. The bus is always given to the first potential master requesting it
d. No potential master can have the bus twice if there are other potential masters which have not yet had access
e. The potential master with the most data to transfer gets the bus first.

Answer d

76. The squeeze operation on a disk drive is usually performed to

a. increase the amount of data that can be stored on the disk
b. concatenate all the empty space into one contiguous area
c. compress each file to reduce the space it takes
d. reduce the track to track spacing
e. none of the above

Answer b

77. Sector interleaving is a technique which is used to

a. put more data on a disk
b. avoid a file spreading over several tracks
c. match the data transfer speeds of the disk and the interface
d. reduce the amount of head movement needed to read a file
e. remove the need for adding pointers at the end of each sector.

Answer c

78. The address space of a computer is determined by

a. the amount of memory installed in the system
b. the number of bits in a register in the cpu
c. the location of the device data register
d. the number of bits represented by the address lines on the bus
e. the number of disk drives installed.

Answer d

79. Fracturing is a problem which happens when

a. a disk head hits the disk surface
b. data is sent over an asynchronous link
c. a file is stored on several tracks across the disk
d. a link in a file is lost
e. data cannot be moved from the disk fast enough.

Answer: c

80. In the arbitration bus, the Bus Release signal is used to

a. signal that the bus is free and available for address and data
b. the bus is available at any priority level
c. the bus is currently busy
d. the address lines are currently in use
e. indicate that a high priority device has requested the bus.

Answer e

81. The squeeze operation on a disk drive is usually performed to

a. increase the amount of data that can be stored on the disk
b. concatenate all the empty space into one contiguous area
c. compress each file to reduce the space it takes
d. reduce the track to track spacing
e. none of the above

Answer b

82. A dedicated bus is best described as one which

a. uses a fully interlocked protocol

b. connects only two devices
c. requires all devices connected to it to operate at the same speed
d. is designed for a particular cpu
e. has no arbitration system.

Answer b

83. An Operating System is best described as

a. An interface for a user to control a computer
b. A software system that provides a virtual machine to the user
c. A system that contains the interrupt handlers
d. A software system that contains basic utilities for the user
e. A system for handling concurrent processes.

Answer b

84. In general, a user process should only communicate with the operating system because

a. If a user process can communicate with the hardware it could control the machine
b. It has to be able to work with files
c. The real memory on the computer may be too small
d. The hardware can only be programmed through the operating system
e. Interrupts could disrupt the functioning of a user process.

Answer a

85. Which of the following is NOT a common form of operating system?

a. Single user, single task
b. Single user, multi task
c. Multi user, single task
d. Multi user, multi task
e. Real time

Answer c

86. How many necessary and sufficient conditions are there for Deadlock?

a. 1
b. 2
c. 3
d. 4

e. 5

Answer d

88. A semaphore is best described as

a. a method of solving the exclusion problem
b. a method for controlling communication between producer and consumer processes
c. a non-negative integer used for control
d. a flag used for signaling
e. a signal used to prevent deadlock

Answer c

89. A mutex is

a. a semaphore used to ensure only one process can access a non-shareable resource at a time
b. a semaphore used to ensure that producer and consumer processes remain synchronized
c. a semaphore used to avoid deadlock
d. a flag used to indicate that a resource is non-shareable
e. a semaphore with a value greater than 1

Answer a

90. Which of the following is NOT a method of resolving a possible Deadlock situation?

a. Avoidance
b. Prevention
c. Detection
d. Exclusion
e. All of the above are methods for resolving deadlock

Answer d

91. Which of the following is true for a Process Control Operating System?

a. The system always runs a single process
b. The system takes actions based feedback from the controlled process
c. All processes execute as quickly as possible
d. It cannot execute multiple tasks
e. No interrupts are allowed.

Answer b

92. The kernel of an operating system is best described as that piece which

a. contains utilities of use to a user
b. interfaces with the user
c. contains the processes for controlling the hardware
d. resides on the disk drive
e. is part of the BIOS

Answer c

93. The BIOS in a computer is primarily used to

a. read in the basic operating system from a disk during the boot process
b. check the operation of a computer before it executes the boot process
c. manage files on a computer disk
d. remove the need for an operating system on the disk
e. manage the memory within a computer system.

Answer a

94. An operating system such as the original Palm OS is basically

a. Real Time
b. Single User, Single Task
c. Single User, Multiple Task
d. Multiple User, Single Task
e. Multiple User, Multiple Task

Answer b

95. Which of the following is a *shareable* resource?

a. The random access memory
b. The disk
c. A CD-ROM
d. A modem
e. A printer

Answer: c

96. Dekker's algorithm solves the exclusion problem by

a. changing the instruction set of the cpu to create indivisible operations
b. using a semaphore to protect a resource
c. monitoring access to a resource
d. monitoring requests for a resource
e. limiting the number of processes which can access a resource

Answer d

97. A traffic light controlling a road junction is an example of

a. a semaphore protecting a resource
b. a method of avoiding deadlock
c. dealing with active processes
d. synchronizing two processes
e. a real time operating system

Answer a

98. A *critical section* is:

a. A sequence of instructions which access a non-shareable resource without branching
b. A section of code encased by the setting and resetting of a logical variable
c. A section of code used to synchronize two processes
d. A sequence of instructions fundamental to the operation of the process
e. A sequence of instructions used for handling an interrupt.

Answer: a

99. In general, a user process should only communicate with the operating system because

a. If a user process can communicate with the hardware it could control the machine
b. It has to be able to work with files
c. The real memory on the computer may be too small
d. The hardware can only be programmed through the operating system
e. Interrupts could disrupt the functioning of a user process.

Answer a