Q: What are the three popular strategies for allocating free memory blocks to processes in dynamic memory partitioning? Explain briefly how each strategy works.

A: First-fit: chooses the first free block in the list that is large enough for the request. Best-fit: chooses the free block that is closest in size to the request. Next-fit: chooses the first free block that is large enough for the request and comes after the ``Last Allocated Block'' in the list.

Q: T/F: Buddy Strategy always allocates memory in chunks of size power of two and uses a data structure based on a binary tree.

A: True.

Q: Give an example drawing of a partially allocated memory and appropriate pointers in which each strategy ends up allocating a different free memory block to satisfy a memory request for 16 MB. Indicate clearly which strategy allocates which memory block.

A: Refer to the example in Chapter 7 slides.

Q: What interrupt is created when a desired page frame is not currently resident in RAM?

A: Page fault trap.

Q: How does the hardware 'know' that a desired page frame is not currently resident in RAM?

A: Valid bit.

Q: What precisely does it mean if the 'dirty bit' is set for a page frame?

A: The page frame has been modified.

Q: What is 'good' vs. 'bad' program locality?

A: 'Good' locality means that the process executes in clustered pages. 'Bad' locality means that the process executes in scattered pages.

Q: Explain when/how internal fragmentation may occur.

A: When fixed-sized pages are used, the last page of a program may be partially filled. This is called internal fragmentation.

Q: Explain when/how external fragmentation may occur.

A: Segmentation system breaks up the memory space into variable-sized pieces. After a sequence of allocation and deallocations, free memory may get fragmented into small pieces. Even if the total size of free memory is large enough to satisfy large memory requests, a large request may not be met due to the lack of continuity between small fragments. This is called external fragmentation. Compaction is needed to put free blocks into one large memory block.

Q: What is a global allocation scheme?

A: Global replacement allows a process to select a replacement frame from the set of all frames, even if that frame is currently allocated to some other process; one process can take a frame from another.

Q: What is a working set model?

A: The working set model assumes that processes execute in localities. The working set is the set of pages in the current locality. Accordingly, each process should be allocated enough frames for its current working set.

Q: Comparing global allocation vs. working set allocation, which would be more adversely affected by a program with 'bad' locality? and WHY would that be true?

A: Working set allocation would be more adversely affected by a program with 'bad' locality. This is because the program with 'bad' locality has poorly defined working sets and therefore, many page faults are likely to occur.

Q: Which one of the following is not among the set of events that may take place between the time a page fault occurs and the time the faulting process resumes execution?

(a) OS blocks the process and puts it into a wait queue.

(b) One of the processes in the ready queue is selected to run.

(c) A DMA is initiated to load the page from disk into main memory

(d) A page replacement strategy is used to find a page frame to load the new page

(e) Page table is updated to reflect the change.

(f) none of the above

A: f

Q: Which one of the following is not among the set of events that may take place between the time a page fault occurs and the time the faulting process resumes execution?

(a) OS blocks the process and puts it into a wait queue.

(b) One of the processes in the ready queue is selected to run.

(c) A DMA is initiated to load the page from disk into main memory

(d) The last page that the faulting process was executing is replaced with the newly loaded page.

(e) Page table is updated to reflect the change.

(f) none of the above

A: d

Q: T/F: While DMA (Direct Memory Access) is taking place, processor is free to do other things. The processor is only involved at the beginning and end of the DMA transfer.

A: True

Q: T/F: DMA uses "cycle stealing" to transfer data on the system bus. Each time cycle stealing is used, CPU is interrupted.

A: False. The only interrupts that occur during DMA transfer is at the beginning and at the end of DMA (no interrupts in between).

Q: What is the "largest" program that could execute on a machine with a 24-bit virtual address?

A: 2^24 bytes

Q: What is the "largest" program that could execute on a machine with a 24-bit physical address?

A: Can't tell. Need to know the size of the virtual (logical) address.

Q: The address contained in a TLB entry <PTE> is (physical | logical).

A: physical

Q: List at least 3 flags that are contained in a PTE.

A: Valid bit, Reference bit, Dirty bit.

Q: Define hit-ratio in a memory management context.

A: In a two-level memory (cache-RAM or RAM-Harddisk), the fraction of all memory accesses that are found in the master memory (i.e. the cache)

Q: T/F: If a virtual page number X generates a miss in the TLB (Translation Lookaside Buffer), then the corresponding physical page number for X is guaranteed to be found in the Page Table Entry.

A: False. Not necessarily. X may not be resident in RAM (still in secondary memory).

Q: True or False? It is possible that page tables are stored in virtual (secondary) memory.

A: True. when multi-level paging schemes are used

Q: T/F: In a virtual memory system with paging, page size must be large enough to offset the high cost of page faults.

A: True

Q: T/F: The Least Recently Used (LRU) page replacement strategy is based on the principle of spatial locality (locality in space) as opposed to temporal locality (locality in time).

A: False. LRU strategy is based on the temporal locality.

Q: T/F: Consider "clock policy" for page replacement, a newly arrived page (i.e. just swapped in) will not get replaced before the clock pointer makes two full rotations in the circular buffer of candidate page frames.

A: True. use=1 at arrival, use=0 after the first rotation of the clock pointer. if use=0 remains true after the second rotation, it may get replaced; otherwise, it stays on.

Q: T/F: In a virtual memory system with paging, you can run a program whose size is larger than the size of Main Memory.

A: True.

Q: Draw a picture which shows the relationship between ``Virtual Address (virtual page#, offset)'', ``Translation Lookaside Buffer'', ``Page Table'', ``Real Address (frame#, offset)'', ``Main Memory'', and ``Secondary Memory''.

A: Slide #18 in CHAP8.ppt

Q: Draw the flowchart for paging using TLB, Page Table, and DMA.

A: Slide #19 in CHAP8.ppt

Q: How does the kernel 'know' where on disk the desired information is for a non-resident frame?

A: If valid bit=0, Page Table Entry should contain the Disk address

Q: Describe what demand paging means.

A: The technique of only loading virtual pages into memory as they are accessed is known as demand paging. If the demand pages are not in memory, a page fault trap happens, and the operation system swaps them in.

Q: Describe what prepaging means.

A: Prepaging brings in more consecutive pages than needed. If a virtual page X causes a pagefault, then virtual page (X+1) is also brought in along with X. It is less overhead to bring in pages that reside contiguously on the disk

-> Must know slides 14 through 20 (in CHAP8.ppt) in detail

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Please fill in the blanks for the following questions:

---**Q:** If a desired page frame is not currently resident in RAM, _________________ occurs.

A: A Page Fault

Q: Since paging system uses ____________________-sized pages, ____________ fragmentation may occur.

A: fixed size;   internal

Q: If a memory management system uses dynamic partitioning, _______________ fragmentation may occur.

A: External

Q: ____________________ is a form of I/O in which a special module controls the exchange of data between main memory and an I/O device. During this I/O transfer, CPU is free to do other computation.

A: DMA (Direct Memory Access)

Q: The least recently used (LRU) page replacement strategy is based on the principle of _________________ as opposed to _______________________.

A: temporal locality;   spatial locality

Q: The top four levels in the memory hierarchy, starting with the fastest, are: _____________; ______________; ___________; ___________

A: Registers; cache memory; RAM; Disk.

Q: Swapping out a piece of a process (i.e. pages of a process) just before that piece is needed is called _______________________

A: Thrashing

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Q: T/F: A unix socket is used for communication between processes running on the same machine. On the other hand, an Internet socket can not be used for communication between processes running on the same machine.

A: False. Internet Socket can be used for processes running on the same machine as well as different machines

Q: T/F If clients are connected to a server through "connect()" and "accept()" calls and the server calls "listen(soc,2)" before "accept()", then at most 2 clients can get connected to the server at anytime.

A: False. listen() determines the size of the wait queue before the connections take place, not the max. number of clients that can get connected.

Q: T/F: In RAID (Redundant Array of Independent Disks) Level 1, every disk in the array has a mirror disk that contains the same data.

A: True.

Q: T/F: In Client/Server architectures, OS and the platforms in the client and server machines must be the same.

A: FALSE

Q: T/F: In Client/Server applications, there is heavy emphasis on providing a user-friendly Graphical User Interface (GUI) on the client side.

A: True.

Q: T/F: In client/server applications, fat client models can not take advantage of the desktop power and therefore can only serve a small number of clients.

A: FALSE

Q: T/F: First-Come-First-Served (FCFS) process scheduling favors I/O-bound processes.

A: FALSE

Q: T/F: Most antivirus software is based on program emulation and virus signature analysis.

A: True.

Q: T/F: RAID 2 (Redundant Array of Independent Disks with Level 2) is designed to provide error detection/correction.

A: True.

Q: T/F: User Datagram Protocol (UDP) provides unduplicated and reliable packet delivery.

A: FALSE

Q: T/F: Two periodic real-time processes A and B have periods T_a=0.2 ms and T_b=0.5 ms respectively. Furthermore, their execution times are _a=10 micro sec. and C_b=40 micro sec. respectively. If Rate Monothonic scheduling is used A has higher priority than B.

A: True.

Q: T/F: The following I/O devices are sorted correctly in decreasing order according to the typical data rates that they can sustain: Gigabit Ethernet, firewire 800, laser printer, hard disk, keyboard, and modem.

A: FALSE

Q: T/F: DMA uses "cycle stealing" to transfer data on the system bus. Each time cycle stealing is used, CPU is interrupted.

A: FALSE

Q: Which of the following strategies is not used in a Disk Scheduling Algorithm?

(a) First in first out (FIFO)

(b) Last in first out (LIFO)

(c) Shortest service time first (SSTF)

(d) Longest service time first (LSTF)

(e) Back and forth over disk (SCAN)

A: d.

Q: Explain what the following C calls do both when the call is successful and when it is unsuccessful.

```
   1. socket( AF_INET, SOCK_STREAM, 0 )
   2. bind(sd, (struct
sockaddr*)&server_addr, sizeof(server_addr))
   3. socket( AF_INET, SOCK_DGRAM, 0 )
   4. accept( sd, (struct
sockaddr*)&client_addr, &client_len )
```

A:

1. creates an Internet stream (TCP) socket and returns the socket descriptor. If the call fails, it returns -1.

2. Binds the definition of a socket (socket descriptor) to a port number. If the call fails, it returns -1.

3. creates an Internet datagram (UDP) socket and returns the socket descriptor. If the call fails, it returns -1.

4. Blocks execution until a client connection is received. When that happens, it returns a descriptor for the connection. If the call fails, it returns -1.

Q: Which one of the following is not among the 7-layers defined for ISO Open Systems Interconnect (OSI) model ?

(a) Application

(b) Routing

(c) Transport

(d) Data Link

(e) Physical

A: b

Q: Which of the following are among the direct goals of process scheduling algorithms (circle all that apply):

a. improve response time

b. minimize interrupts

c. improve throughput

d. minimize page faults

e. improve turnaround time for jobs

f. increase memory efficiency

A: a, c, e

Q: When we compare clusters with SMP (Symmetric Multiprocessors), which of the following are true (circle all that apply)?

a. Clusters are easier to manage and configure

b. Clusters take up less space and draw less power

c. Clusters are better for incremental and absolute scalability

d. Clusters are superior in terms of availability

e. Clusters have superior price/performance

A: c, d, e

Q: Which of the following malicious software need a host program to operate? (circle all that apply)

a. Logic Bomb

b. Worm

c. Zombie (bots)

d. Trojan Horse

e. Virus

A: a, d, e

Q: Which of the following scheduling policies may cause starvation for certain jobs? (circle all that apply)

a. First Come First Serve (FCFS)

b. Feedback

c. Round Robin

d. Shortest Process Next (SPN)

e. Shortest Remaining Time Next (SRT)

A: b, d, e

Q: Which of the following features are specific to Real-Time OS? (circle all that apply)

a. Small size

b. Fast context switch

c. Less user control

d. Nondeterministic delays

e. Fail-safe operation

A: a, b. e

Q: In which one of the following OSI layers Transmission Control Protocol (TCP) and User Datagram Protocol (UDP) are defined and implemented?

a. Application

b. Physical

c. Transport

d. Data Link

e. Session

A: c

Q: What does an Internet Protocol do?

A: *1.* Provides a naming scheme which uses a uniform format for host addresses

2. Provides a delivery mechanism by defining a standard packet format.

Q: T/F: Sockets are bidirectional communication ports in UNIX. Once a socket is created, it can be bound to an Internet port using socket() call.

A: False. First statement is true but the 2. statement is false. Sockets can be bound to an Internet port using bind() call.

Q: T/F: There is only one Internet port in each networked host.

A: False. There are many Internet ports in each host; some are reserved by the OS.

Q: T/F: The UNIX call listen(soc,N) allows only N clients to be connected to a socket at any time.

A: False. N specifies the length of the wait queue for the clients who are waiting to be connected.

Q: T/F: The two lowest layers in the 7-layer ISO Open Systems Interconnect (OSI) model are Physical and Data Link layers and their primary function is to implement the TCP/IP protocol.

A: False. First part of the statement is true but the second part is false, because Transport layer (which is the 4. layer from the bottom) implements TCP/IP.

Q: What are the possible goals that any scheduling policy might try to accomplish (list at least three)?

A: To improve:

- response time
- Turnaround time (TAT)
- Throughput
- Processor Efficiency

Q: T/F: Long-Term scheduler controls the degree of multiprogramming

A: True

Q: T/F: Among the three scheduling disciplines (long-term, medium-term, and short-term), long-term scheduler executes most frequently.

A: False. Short-term scheduler (dispatcher) executes most frequently.

Q: T/F: Among the short-term scheduling policies, feedback policy penalizes jobs that have been running longer.

A: True

Q: Which decisions are made by Long-term, Medium-term, and Short-term scheduling? Be brief.

A:

Long-term scheduling:
Determines which programs are admitted to the system for processing; Controls the degree of multiprogramming

Medium-term scheduling:
Determines which programs will be resident. Part of the swapping function; Swapping-in decision is based on the need to manage the degree of multiprogramming

Short-term scheduling:
Determines which program will be executed on CPU next. Known as the dispatcher; Executes most frequently

Q: Name 3 things that are essential to launch a "`bots"' attack:

A: *(1)* attack software

(2) a large number of vulnerable machines

(3) locating these machines (scanning or fingerprinting)

==

Please fill in the blanks for the following questions:

Q: The two lowest layers in the 7-layer ISO Open Systems Interconnect (OSI) model are __________ and ____________ layers and their primary function is to provide _______ and _________

A: Physical; Data Link; signaling technology; frame management.

Q: Two transport protocols, ___________ and ____________, are defined and handled at the Transport Layer.

A: Transmission Control Protocol (TCP); User Datagram Protocol (UDP)

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Miscellaneous questions related to the
VIDEO: TRIUMP OF THE NERDS

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Q: Fill in the blanks.

1. _____________ and ____________ are generally credited with the invention of C/Unix?

A. Dennis Richie, Ken Thompson.

2. __________ and ___________ started Microsoft in 19______.

A. Bill Gates, Paul Allen, 1975.

3. What corp./laboratory may fairly take credit for inventions like the mouse, windows, pull-down menus etc.?

A. Xerox/PARC

4. ____________ and ___________ co-founded Apple. __________ then started NeXT, and is now the CEO of Pixar?

A. Steve Jobs, Steve Wozniac, Steve Jobs

5. MS/DOS was 90% derived from a predecessor product named ________ which was written by _______ and owned by ___________. which in turn had been cloned from ________ written by ______

A: QDOS, Tim Patterson, CL Computer Products, CPM, Gary Kildall

Q: Answer the following questions.

6. What did Steve Jobs see while visiting PARC that inspired him to build a different kind of computer?

A: GUI

Q: What did he see that he completely ignored?

A: object oriented programming and E-mail

Q: What was the 1st computer that he built based on this inspiration (that flopped)?

A: Lisa

Q: What was the 2nd one that didn't flop?

A: Macintosh

7. What 'product' got Microsoft into the microcomputer software business?

A: BASIC language interpreter

8. What lucky event got Microsoft into the operating system market? Gary Kildall didn't eagerly pursue IBM when they requested a new OS. His wife and attorney would not sign a nondisclosure agreement. Bill Gates of Microsoft saw this as an opportunity and jumped in.

9. What company purchased NeXT and their OS NExTStep? What year?

A. Apple, in 1996

10. What is a 'killer application'?

A: Software that's so useful that people will buy computers just to run it.

11. What was the killer app for the Apple II?

A: Visicalc

12. What was the killer app for the IBM PC?

A: Lotus 1-2-3

13. What was the killer app for the Apple MacIntosh?

A: WYSIWYG - What you see is what you get -----> Desktop Publishing

14. Why didn't IBM create their own OS for their 1st PC?

A: wanted to manufacture and market it very fast; within one-year "....Once IBM decided to do a personal computer and to do it in a year -   they couldn't really design anything, they just had to slap it together, so that's what they did ..."

15. Who 'should have' sold IBM their operating system for the 1st IBM PC?

A: Gary Kildall of Digital Research

16. What was the one part of the 1st IBM PC that was proprietary (that Compaq had to later reverse engineer)?

A: ROM-BIOS

17. Why did IBM decide to build the PC using 'open architecture'?

A: To save time, instead of building a computer from scratch, IBM initially decided to buy PC components off the shelf and assemble them -- in IBM terms, this was called an 'open architecture'. IBM made some changes to this initial decision. What was the almost immediate result of IBM having made that decision?
IBM had to buy the OS and other software from other companies as well.

18. What was IBM's motivation for designing/building PS-2/OS-2?

A: IBM planned to steal the market from Gates with a brand new OS called OS/2.

19. What person _________ what company _________ built the 1st commercially available personal computer in 1975?

A: Ed Roberts; MITS

20. Gordon Moore is one of the _______ founders.

A: Intel

21. World's first personal computer, _________, was designed by ________ and was introduced in 19___

A: Altair 8800; Ed Roberts; 1975

22. The first mass market PC company is ______.

A: Apple

Base Address – an address that is used as the origin in the calculation of addresses in the execution of a computer program

Dynamic Relocation – a process that assigns new absolute addresses to a computer program during execution so that the program may be executed from a different area of main storage

Indexed Access – pertaining to the organization and accessing of the records of a storage structure through a separate index to the locations of the stored records

Indexed Sequential Access – pertaining to the organization and accessing of the records of a storage structure through an index of the keys that are stored in arbitrarily partitioned sequential files

Last In First Out (LIFO) – a queuing technique in which the next item to be retrieved is the item most recently placed in the queue

Logical Address – a reference to a memory location independent of the current assignment of data to memory. A translation must be made to a physical address before the memory access can be achieved.

Memory Partitioning – the subdividing of storage into independent sections

Page – in virtual storage, a fixed length block that has a virtual address and that is transferred as a unit between main memory and secondary memory

Page Fault – occurs when the page containing a referenced word is not in main memory. This causes an interrupt and requires that the proper page be brought into main memory.

Paging – the transfer of pages between main memory and secondary memory

Physical Address – the absolute location of a unit of data in memory (e.g., word or byte in main memory, block on secondary memory)

Real-Time System – an operating system that must schedule and manage real-time tasks

Sequential Access – the capability to enter data into a storage device or a data medium in the same sequence as the data are ordered or to obtain data in the same order as they were entered

Sequential File – a file in which records are ordered according to the values of one or more key fields and processed in the same sequence from the beginning of the file

Server – (1) a process that responds to request from clients via messages. (2) In a network, a data station that provides facilities to other station; for example, a file server, a print server, a mail server.

Spooling – the use of secondary memory as buffer storage to reduce processing delays when transferring data between peripheral equipment and the processors of a computer

Trojan Horse – secret undocumented routine embedded within a useful program. Execution of the program results in execution of the secret routine.

Trusted System – a computer and operating system that can be verified to implement a given security policy

Virtual Address – the address of a storage location in virtual storage

Virus – secret undocumented routine embedded within a useful program. Execution of the program results in execution of the secret routine.