e) Is it possible to store program and data permanently in the main memory? Give reasons to justify your answer

1- Resident operating system.   [2 M]

2- User processes than held in high memory.

3- Each process contained in single contiguous section of memory

Q2.

a) Fill in the blanks with right words. Each part is worth one mark.   [5 M]

1. Set of all processes residing in main memory, ready and waiting to execute are in __Ready__ queue

2. Set of processes waiting for an I/O device resides in __Devic__ queue.

3. __Bootstrap__ program is loaded at power-up or reboot and loads OS into memory

4. Device controller informs CPU that it has finished its operation by causing an __interrupt__

5. __Protection__ is the mechanism for controlling access of processes or users to resources

b) Mention the reasons for cooperating processes? How do cooperating processes communicate?   [2 M]

1- Information sharing.
2- Computational speedup.
3- Modularity.
4- Convenience.

c) What are the Scheduling Algorithm Optimization Criteria   [1 M]

1- Max cpu utilization.
2- Max throughput.
3- Min turnaround time.
4- Min waiting time.
5- Min response time.

waiting time for :
P2=0
p5=1
p1=6
p3=16
p4=18

Process	Burst Time	Priority
P1	10	3
P2	1	1
P3	2	4
P4	1	5
P5	5	2

| P₂ | P₅ | P₁ | P₃ | P₄ |
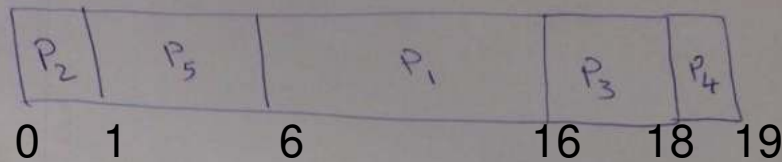
0 1   6   16   18 19

Average waiting time = (0 + 1 + 6 + 16 + 18)/5 = 8.2 ✓

Q3.

a) Fill in the blanks with right words. Each part is worth one mark.   [5 M]
   1. Divide physical memory into fixed-sized blocks called _frames_
   2. Divide logical memory into blocks of same size called _Pages_
   3. A program is a collection of _segments_
   4. Virtual memory can be implemented via _Demand Paging_ and _Demand-segmetion_
   5. The process of associating program instructions and data to physical memory address is
   called _segments_ address binding or relocation.

b) What is a Memory-Management Unit?   [1 M]

Hardware device that at run time maps virtual to Physical address.

c) Explain two types of fragmentation.   [2 M]

External fragmentation: total memory space exists to satisfy a request; but it is not contiguous.

Internal fragmentation: allocated memory may be slightly larger than requested memory.

d) Consider the following paging model of logical with a paging table given below. Draw paging model of physical memory allocation [1 M]

page 0
page 1
page 2
page 3
logical memory

0	1
1	4
2	3
3	7

page table

```
0
1   Page 0
2
3   Page 2
4   Page 1
5
6
X   Page 3
```

or the question will be like in slides which means to
Find the specific letter in physical memory by using next rule:
(index of page table * number of page in page table) + offset of the letter in logical memory

e) Consider a swapping system in which memory consists of the following hole sizes in memory order: 10K, 4K, 20K, 18K, 7K, 9K, 12K, and 15K. Which hole is taken for successive segment requests of: [1 M]

   a. 12K
   b. 10K
   c. 9k
   for

i.   First-fit?   a)20K b)10K c)18K
ii. Best-Fit? a)12K b)10K c)9K
iii. Worst Fit? a)20K b)18K c)15K

Q4.

a) The Directory is organized logically to obtain ___All___
   1. Efficiency
   2. Naming   [1 M]
   3. Grouping
   ④ All

b) Masking is used to delay or ignore some interrupts. True or False?

c) Mention six attributes of a File?   [1 M]

          [2 M]

1- Name

2- Type

3 - Location

4- Size

5- Protection

6 - Time , data , and user identification

Question No	1	2	3	4	5	Total
Max Marks	10 M	10 M	10 M	10 M	10 M	40 M
Marks Obtained						

Instructions: *Please read the questions carefully and provide your answers in the provided space. You need to answer all questions on four pages.*

Q1.

a) An Operating System is interrupt-driven. True or False? [1 M]

b) When a computer is first turned on or restarted, a special type of loader called _____ is executed. [1 M]
    1. Compile and Go loader
    2. Boot loader
    ③ Bootstrap loader
    4. Relating Loader

c) What is an Operating System? Mention any three goals of an operating system? [3 M]

Operating System: a Program that acts as an intermediary between a user of a computer and the computer hardware.
* Goals:-
    1- Execute user Programs and make solving user problems easier
    2- Make the computer system convenient to use. ✓
    3- Use the computer hardware in an efficient manner.

d) Mention any eight services provided by the Operating System [3 M]

1 - program execution.

2 - communication.

3 - 1/0 operations. ✓

4 - File systems.

5- Error detection.

6- Protection and security.

7- Accounting.

8- Resource allocation.

b) Mention any three program threats and three system threats

[2 M]

Progam threat's :-

1- Trojan horse.

2- Trap doors

3- stack and buffer overflow.

System threats :-

1- worms

2- viruses

3- Denial of service

c) What does Intrusion detection do?

[1 M]

1- Auditing and logging.

2- Tripwire.

d) Please circle the right choice, each part is worth one mark

[5 M]

1. Protection ensure that each object is accessed correctly and only by those processes that are allowed to do so

TRUE / FALSE

2. In an Access matrix, Columns represent domains and Rows represent objects

TRUE / FALSE

It is Easier to protect against malicious than accidental misuse

TRUE / FALSE

Cryptographic protocol limits two computers to only exchange messages with each other

TRUE / FALSE

e firewall doesn't limits network access between trusted and untrusted hosts

TRUE / FALSE

d) Match the following

[1 M]

1. Boot-control block	1. contain details about ownership, size, permissions, etc — 3
2. Volume control block	2. contains information about how to boot the system — 1
3. File Control Block	3. contains information such as the partition table — 2

e) Given the list of track requests: 51, 10, 36, 48, 20, 0, 100, 15 (with 51 first), apply the FCFS and SSTF disk head scheduling algorithms to determine the total head movement for this list of requests. Also give a diagram showing the head movement. Assume the head starts at track 70. Assume a minimum track number of 0, and a maximum track number of 150.

[2 M]

SSTF

FCFS
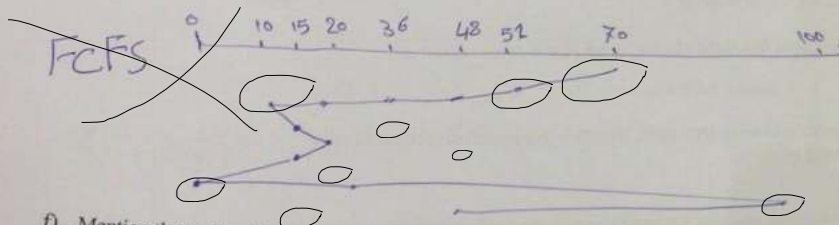
f) Mention three allocation methods for disk blocks?

[1 M]

1- Contiguous.

2- Linked

3- Indexed ✓

Q5.

a) What are the goals of Protection and Security?

[2 M]

Protection: any mechanism for controlling access of processes OR access of users to resources defined by the OS.

Security: defense of the system against internal and extern attacks worms, viruses, identity heft, etc ✓

MIDTERM EXAM - OPERATING SYSTEMS

Student Name: _____

Student ID: _____

Section: _____

Tot. Marks: 20 M

Time : 1.5 hrs

Date : 14ᵗʰ April'14

Question	Q1	Q2	Q3	Q4	Q5	TOTAL
Marks						/ 20

Q1. a) What is a System Call?

when a process make request of the
kanel the request system call [1 M] ✓

b) Mention the different types of system calls?

Process control
file mangement
Device mangement
Protection [1 M] ✓

c) System call is a programming interface to the services provided by the OS
☑ TRUE / FALSE

d) System program M provides a convenient environment for program development and execution [0.5 M] ✓

e) What are the User goals and the System goals in the design of an Operating System [0.5 M] [1 M]

operationg system shouldebeconvenirty to use
easy to learn reliable, safe and
fast ✓

See the answers from slides
his font very beautiful =')

Q2. a) Mention four sections of process memory? [1 M]

1.The text section☑
2 -the date section   4-the stak usedfor local
3 -the heap is used✓   variable

b) Draw the diagram of a process state? [1 M]

new
Ready
running ✓
terminate
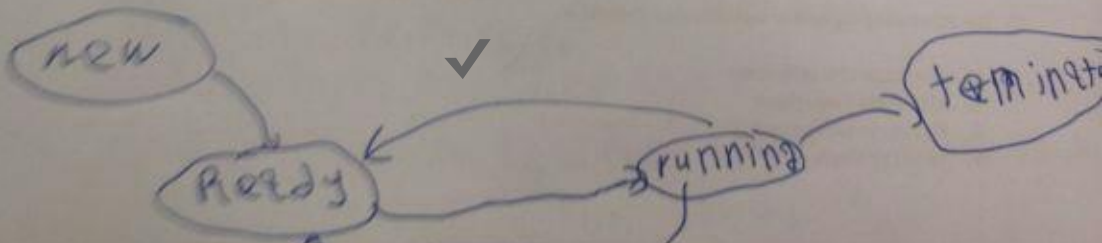
A priority number (integer) is associated with each process Priority Scheduling

c) A priority number (integer) is associated with each process in Priority scheduling.
   (TRUE) / FALSE

Q4. a) Concurrent access to shared data may result in data inconsistency.
   a) Concurrent access to shared data may result in _____ [0.5 M]

b) Semaphore mutex initialized to the value __1__ ; Semaphore full initialized to the value __0__ ;
   Semaphore empty initialized to the value __N__
   1) 0
   2) 1
   3) -1
   4) N
   [0.5 M]
   [1.5 M]

c) Mention the Readers-Writers Problem?
Ans) [1 M]
allow MULTIPLE readers to read at same time only one single writer can acsess the shared data at the the same time

d) Mention any two problems related to deadlock?
Ans) [1 M]
**① starvation
② priority**

Q5. a) Define a Deadlock in a process?
[1 M]
The PERMANENT blocking of a set of Processes that compete for system

b) Deadlock can arise if four conditions hold simultaneously. Mention them? [1 M]
Mutual exclusion
Hold and wait
No preemption resources cannot be preempted
Circular wait

c) Draw the Wait-For Graph for the given Resource Allocation Graph, detecting a Deadlock.
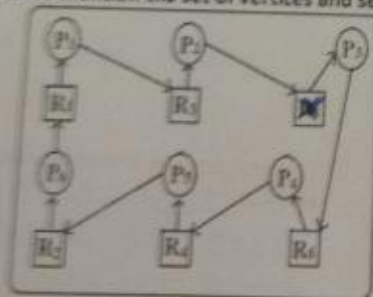   Also, please mention the set of vertices and set of edges.
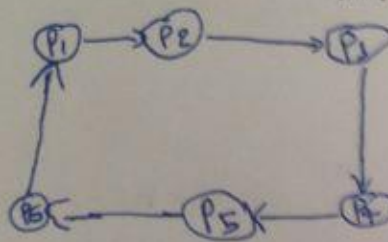   [2 M]

Fig. Resource Allocation Graph

Fig. Wait-For Graph

Vertices: **P₁, P₂, P₃, P₄, P₅, P₆
R₁, R₂, R₃, R₄, R₅, R₆**

Edges: **R₁→P₁, R₃→P₂, R₅→P₃, R₆→P₄, R₄→P₅, R₂→P₆, R₁**

b) _____ scheduler is invoked very frequently (milliseconds) [0.5 M]

   1) Short-Term
   2) Medium-TerM
   3) Long-Term
   4) None

c) ~~I P C~~   context switch _____ is the process of storing and restoring the state (context) of a process so that execution can be resumed from the same point at a later time. [0.5 M]

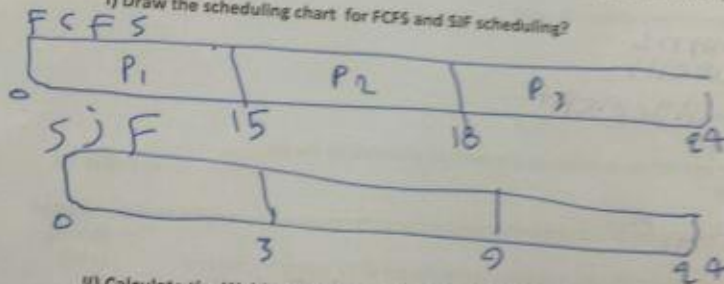d) Define Interprocess Communication and Mention two Models of IPC [1 M]

   ① shared memory

   ② message passing ✓

Q3.

a) Consider the processes arriving in the order: P1, P2, P3 with the burst time as 15, 3, and 6 respectively

I) Draw the scheduling chart for FCFS and SJF scheduling? [1 M]

FCFS

P1	P2	P3

0   15   18   24

SJF

0   3   9   24

II) Calculate the Waiting time for each process in FCFS and SJF scheduling? [1 M]

FCFS = $P_1 = 0$, $P_2 = 15$, $P_3 = 18$

SJF = $P_1 = 9$, $P_2 = 0$, $P_3 = 3$ ✓

III) Calculate the average waiting time for both FCFS and SJF scheduling? [1 M]

FCFS = $(0 + 15 + 18)/3 = 11$

SJF = $(9 + 0 + 3)/3 = 4$ ✓

b) The Scheduling Algorithm Optimization Criteria is [0.5 M]

   1. Minimum CPU utilization
   2. Maximum throughput
   3. Maximum turnaround time
   4. All of the above

ch: 3,4,5

Process: Program in execution
Diagram of Process States:-

new → admitted → Ready → interrupt → Running → exit → Terminated
scheduler dispatch
I/O or event completion → waiting ← I/o or event wait

Process in memory

| stack |
| ↓ |
| ↑ |
| heap |
| data |
| text |

(FCFS) = First Come, First served:-

Process	Burst Time
P₁	24
P₂	3
P₃	3

waiting time: P₁ = 0
P₂ = 24
P₃ = 27

average: (0 + 24 + 27)/3 = 17

| P₁ | P₂ | P₃ |
0   24   27   30

(SJF) Shortest Job First

Priority Scheduling:-

Process	Burst Time	Priority
P₁	24	2
P₂	3	3
P₃	3	1

waiting: P₃ = 0
P₁ = 3
P₂ = 27

average: (0 + 3 + 27)/3

| P₃ | P₁ | P₂ |
0   3   27   30

★ Semaphore: Synchronization tool that does not require
busy waiting.

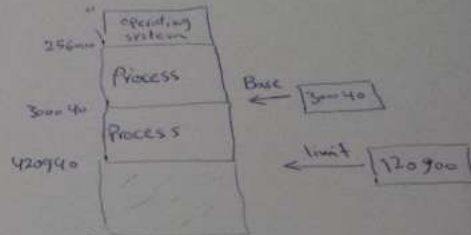~ wait (S) {
    while S<=0; // no-op
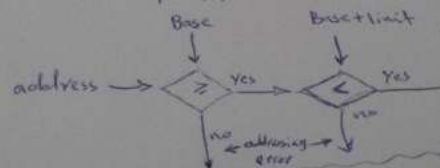   S--;
}

~ signal (S) {
    S++;
}

* **Background:** Program must be brought (from disk) into memory and placed within a process for it to be run.

* **Cache:** sits between main memory and CPU registers.

Base and limit Registers:-

Base + limit to define the logical address space.


```
            "  | operating |
      256m  |  | system   |
            |  |----------|
            |  | Process  |      Base
            |  |----------|        <---  | 3m 40 |
      3m 40 |  |          |
            |  | Process  |      limit
      420940|  |----------|        <---  | 120 900 |
            |  |          |
            |  |_____|
```

---

* **Hardware Address protection with Base and limit Registers:-**

```
                Base            Base+limit
                 |                 |
                 v                 v
address --->  / ≥ \ --yes-->  / < \ --yes-->
              \   /           \   /
               |               |
               no   <-addressing->  no
                v      error        v
```

* **memory-management-Unit (MMU):-** Hardware device that at runtime maps virtual to physical address.

---

* **Swapping:** A Process can swapping temporarily out of memory to Backing Store, and then brought back into memory for continued execution.

---

* **Fragmentation:** 1- External Fragmentation.
  2- Internal Fragmentation.

*Access methods:-

 # Sequential Access:
 read next
 write next
 reset
 {no read after last write
 (rewrite)

 * Direct Access:
 read n
 write n
 Position to n
 read next
 write next
 rewrite n

*Allocation methods:- refers to how disk block are allocated. for files.

 °typs:-
 -Contiguous allocation.
 - linked allocation.
 -Indexed allocation.

*Standard levels:

 * RAID 0: striping.
 * RAID 1: mirroring.
 * RAID 2: ~~striping with~~ bit-level, Hamming-Code parity.
 * RAID 3: byte-level, striping with dedicated parity.
 * RAID 4: block-level ~ ~ ~ ~
 * RAID 5: ~ ~ ~ ~
 * RAID 6: ~ ~ ~ ~ double distributed parity.

Program threats:-

           * Trojan Horse.
           * Trap Door.
           * Stack and Buffer overflow.

System Threats:-

        * worms.
        * Internet worm.
        * viruses.
        * Denial of Service.

Q8.

a) __Protection__ ensure that each object is accessed correctly and only by those process that are allowed to do so. **[1 M]**

b) In an Access Matrix, rows represent ___objects___ and columns represent ___Domains___
   1. Domains
   2. Objects
   [1 M]

in Access matrix rows represent objects & columns represent domain

c) Protection is handled in JAVA by the ~~Firewall~~ JVM **[1 M]**

d) _____ checks for several incorrect password attempts and may signal password guessing.
   1. Threat Monitoring
   2. Firewall
   3. Encryption
   4. None **[1 M]**

e) Mention any three Program Threats? **[1 M]**
   1- Trojan Worms
   2- Trap Door.
   3- Steak and Buffer overflow

f) Mention any three System Threats? **[1 M]**
   1- worms.
   2- internet worms
   3- viruses.

g) Match the following **[2 M]**

Threat Monitoring	1 limits network access between two security domains
Firewall	3 detect attempts to intrude into computer systems
Intrusion Detection	4 encrypt clear text into cipher text
Encryption	2 check for suspicious patterns of activity

Mention 2 access method of file? [1 M]

Q4.

a) Mention two access methods of a File?
  1. Sequential Access.
  2. Direct Access

Directory is organized .. [1 M]

b) The Directory is organized logically to obtain _____
  1. Efficiency
  2. Naming
  3. Grouping
  4. All

file system reside in 2nd storage [1 M]

c) File system resides on secondary storage. True/False

boot & volume & file ,, see slides [1 M]

d) Match the following

|	
boot-control block	contain details about ownership, size, permissions, etc
volume control block	contains information about how to boot the system
File Control Block	contains information such as the partition table

mention 3 allocation methods of disk blocks [1 M]

e) Mention three allocation methods for disk blocks?

1- Contiguous allocation.
2- Index allocation.
3- Linked allocation.

f) Given the list of track requests: 51, 10, 36, 48, 20, 0, 100, 15 (with 51 first), apply the FCFS and SSTF disk head scheduling algorithms to determine the total head movement for this list of requests. Also give a diagram showing the head movement. Assume the head starts at track 70. Assume a minimum track number of 0, and a maximum track number of 150. [2 M]

FC FS

SSTF = SJF

First Come First Serve

Q1.
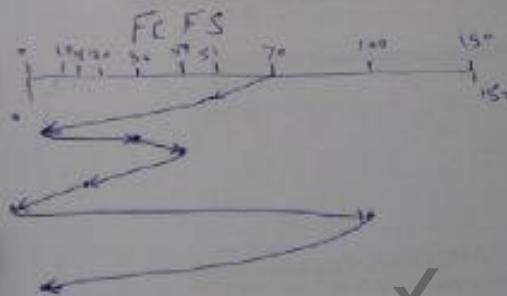
a) What is an Operating System?

Program notes between user of computer and [1 M]
Computer hardware –

Bootstrap

b) ~~Bootstrap~~ Program _____ is a special type of loader that is executed when a computer is first turned on or restarted. [1 M]

c) The occurrence of an event is usually signaled by_____ [1 M]
   1. Interrupt
   2. System Call
   3. Operating System
   4. None

d) Mention any three advantages of multiprocessor systems? What are the two types of multiprocessing? [3 M]

Increased
1 - ~~Increased reliabiliti~~ reliabilities   *Types:*
2 - ~~Increased~~ increased throughput   *1. Asymmetric multiprocess*
3 - Economy of scale.   *Symmetric multiprocess*

e) Software may trigger an interrupt by executing a special operation called a system call. [1 M]
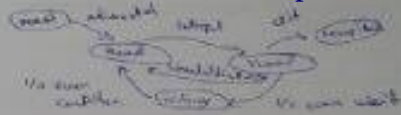   (True) / False

f) What are clustered systems?   // important   [1 M]
multiple systems working together.

r multiple systems working together

a) What is a process?

// I cant see :(

b) __Swapping__ is the process of storing and restoring the state of a process so that execution can be resumed from the same point at a later time. [1 M]

c) Draw the Diagram of Process State? [2 M]

process state

d) The scheduling algorithm optimization criteria is [1 M]
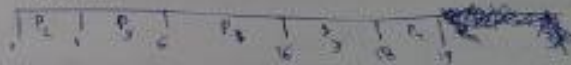1. Max CPU utilization
2. Max throughput
3. Min turnaround time
4. Min waiting time
5. All of the above

// focus here

e)

Process	Burst Time	Priority
P1	10	3
P2	1	1
P3	2	4
P4	1	5
P5	5	2

1. For the set of processes mentioned above, draw a Gant chart for the Priority Scheduling Algorithm. [1 M]

2. For the set of processes mentioned above, calculate the average waiting time for the Priority Scheduling Algorithm. [1 M]

Average = (0 + 1 + 6 + (6 × 16))/5 = 8.2

f) __SEMAPHORE__ is a synchronization tool that does not require busy waiting. [1 M]

2/

Q3.

MMU definition // important

i) What is a Memory-Management Unit? [1 M]

Hardware [handwritten] that at runtime maps virtual to physical addresses

✓

b) Explain two types of fragmentation. [2 M]

*1- External fragmentation
2- Internal fragmentation*

// 2 types of fragmentation with their defention

10k ,4k,20k,18k,7k,9k,12k,15k

c) Consider a swapping system in which memory consists of the following hole sizes in memory order: 10K, 4K, 20K, 18K, 7K, 9K, 12K, and 15K. Which hole is taken for successive segment requests of : 12K   // request for 12k

[2 M]
for

  i.   First-fit? *20* ✓
  ii.   Best-Fit? *12* ✓
  iii. Worst Fit? ✗   18K

d) Virtual memory can be implemented via ___PAGING___ and Segmentation [1 M]

※

e) _____ is a memory-management scheme that supports user view of memory

[1 M]

  ① Segmentation
  2. Paging
  3. Fragmentation
  4.✗ None

f) Consider a process size of 20,000 bytes and a page size of 1024 bytes. Calculate internal fragmentation?

see slides [1 M]

*20,000 ÷ 1024 = 19.5
20 × 1024 = 20480

20480 - 20,000 = 480 bytes* ✓

* Before my final exam I saw this , then I discovered that some answers were wrongs
and I felt too angry from this student :@ , So I spent some time after exams to edit it ..
I hope if I edit all wrong answers ,
if u find any other mistakes u can edit it and inform ur friend and send back to me ^_^
Best Regrades ~
Dr. Someone * ;P

Umm Al-Qura University
College of Computer and Information Systems
Computer Sciences Department

Operating Systems
Hussam A Mohammed
Midterm Exam
Date: 19th Nov 2014
Time Allowed: 60 min
Max Marks : 20

Student Name: _____

Student Number: _____

Section: _____

Question No	1	2	3	4	5	Total
Max Marks	4 M	4 M	4 M	4 M	4 M	20 M
Marks Obtained						

Instructions: Please read the questions carefully and provide your answers in the provided space. You need to answer all three questions on four pages.

Q1.

a) What is an Operating System? Mention three goals of an operating system?   [2.5 M]

A program that acts as an intermediary between a userof a computer and the computer hardware

Operating system goals:
1- Execute user programs and make solving user problems easier
2- Make the computer system convenient to use
3-Use the computer hardware in an efficient manner

b) A _____Trap_____ is a software-generated interrupt caused either by an error or a user request

[0.5 M]

c) _____Bootstrap loader_____ is a special type of loader that is executed when a computer is first turned on or restarted.   [0.5 M]

d) Device controller informs CPU that it has finished its operation by causing an ___Interrupt___ [0.5 M]

Q2.

a) Give two reasons for why the programs and data cannot reside in main memory (RAM) permanently
[1.5 M]

1- Main memory is usually too smallto store all needed programs and data permanently.

2- Main memory is a volatilestorage device that loses its contents when power is turned off.

b) _____Cache_____ is a component that transparently stores data so that future requests for that data can be served faster
[0.5 M]

c) _____Register_____ is a special, high-speed storage area within the CPU where all data must be represented before it can be processed.
[0.5 M]

d) _____Secondary storage_____ is an extension of main memory that provides large nonvolatile storage capacity.
[0.5 M]

e) Arrange the following Storage systems in a hierarchy such that higher levels are expensive and fast.
[1 M]

1. Volatility
2. Speed
3. Cost

1.	Speed
2.	Cost
3.	Volatillity

Q3.

a) What are the User goals and the System goals in the design of an Operating System
[1 M]

User goals – operating system should be convenient to use, easy to learn, reliable, safe, and fast

»System goals – operating system should be easy to design, implement, and maintain, as well as flexible, reliable, errorfree, and efficient

c) _____System call_____ is a programming interface to the services provided by the OS
[0.5 M]

[1 M]

b) What is a System Call?

process makes requests of the kernel, the request is called a
system call

[1 M]

d) Mention any five different types of system calls?

        1- Process control   2- File management
        3- Device management 4-Information maintenance
        5- Com   munications   6- Protection

e) __System programs__ provides a convenient environment for program development and execution

[0.5 M]

Q4.

[1 M]

a) Define Inter-process Communication? Mention two Models of IPC?

is a set of methods for the exchange of data among multiple
threads in one or more processes

Two models of IPC :
1- Shared memory 2- Message passing

[1 M]

b) Draw the diagram of a process state?

    Ch 3 slide 7

[0.5 M]

c) __Short time__ scheduler is invoked very frequently (milliseconds)

1) Short-Term
2) Medium-Term
3) Long-Term
4) None

d) __Context switch__ is the process of storing and restoring the state (context) of a process so that
execution can be resumed from the same point at a later time.

[0.5 M]

[1 M]

e) Mention four sections of process memory?

    1- text section
    2- data section
    3- heap
    4- stack

Q5.

a) Consider the processes arriving in the order: P1, P2, P3 with the burst time as 15, 3, and 6 respectively

    I) Draw the scheduling chart for FCFS and SJF scheduling?   [1 M]

Ch 5

    II) Calculate the Waiting time for each process in FCFS and SJF scheduling?   [1 M]

    III) Calculate the average waiting time for both FCFS and SJF scheduling?   [1 M]

b) The Scheduling Algorithm Optimization Criteria is   [0.5 M]
1. Minimum CPU utilization
2. Maximum throughput
3. Maximum turnaround time
4. All of the above

2

c) A priority number (integer) is associated with each process in Priority scheduling   [0.5 M]
   TRUE / FALSE

True

OPERATING SYSTEMS QUIZ-2

Student Name: _____

Student ID: _____

Section: _____

Tot. Marks: 10

Marks Obtained: /10

Q1.   a) A process requests resources; and if the resources are not available at that time, the process enters __2__
1. Running State
2. Waiting State
3. Execution
4. None

[0.5 M]

b) Give one example of a Deadlock?   [1 M]

   System has 2 tape drives.

c) Deadlock occurs if resource allocation graph contains no cycles.   TRUE / FALSE   [0.5 M]

d) Mention the method of handling deadlock in Unix Operating System?   [1 M]

   Ignore the problem and pretend that deadlocks never occur in the system

e) Match the following for a Deadlock Prevention?   [1 M]

1	Mutual Exclusion	Order resources numerically	4
2	Hold and Wait	Take resources away	3
3	No Preemption	Request a resourse initially	2
4	Circular Wait	Spool everything	1

f) Mention the three combined approaches for deadlock handling?   [1 M]

   1- prevention.   2- avoidance   3-detection

Q2.   a) Mention two registers used for the protection of Memory required to ensure correct operation?   [1 M]

   1-The base register.   2-The limit register.

b) The process of associating program instructions and data to physical memory addresses is called __1__
1. Address Binding
2. Dynamic Loading
3. Dynamic Linking

[0.5 M]

c) Let us assume that the user process is 20 MB in size and the backing store is a standard hard disk with a transfer rate of 80 MB per second and an average latency of 8 msec. What is the swap time?   [1 M]

   The actual transfer of the 20-MB process to or from main memory takes
   20MB / 80MB per second = 1/4 second = 250 ms.   Notic:\
   With Latency of 8ms Swap Time = 250ms + 8ms = 258ms   Convert frome scand to
   Since we must both swap out and swap in,total swap time = 2*258ms = 516 ms   ms we multibly by 1000

d) ____1____ and ____3____ are only storage CPU can access directly.   [0.5 M]
   1. Main Memory   2. Secondary Memory   3. Registers

e) Mention the two partitions of the Main memory?   [1 M]

   1-Resident operating system.   2-User processes

f) Calculating internal fragmentation, if page size is 2,048 bytes and a process is of 72,766 bytes ?   [1 M]

slide 27.   Ch 7