

- i) Answer any **SIX** questions, out of the following **Eight** questions.  
 ii) All questions are of equal values.

1. a) Explain the phases of a compiler for the following assignment statement: 4  
 (position := initial + rate \* 60)
- b) Consider the CFG with the following production rules: 4

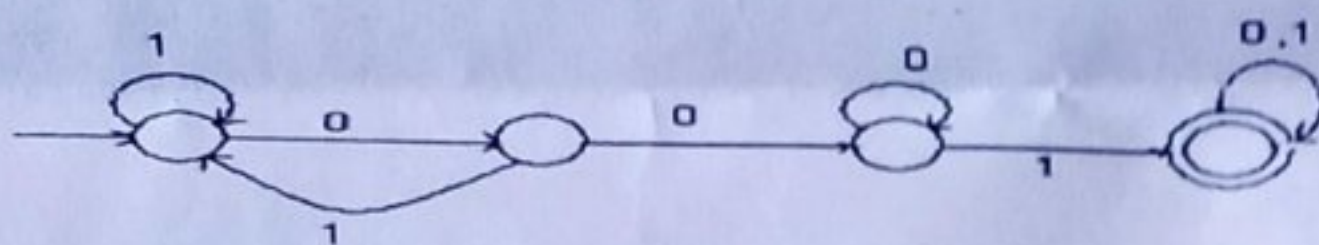
$S \rightarrow aB / bA$   
 $A \rightarrow bAA / aS / a$   
 $B \rightarrow aBB / bS / b$

Give the right most derivation and draw derivation tree for the string **abbaab**.

- c) What is the purpose of semantic analysis in a compiler? 2
2. a) Construct a DFA equivalence to the regular expression  $(0+1)^*(00+11)(0+1)^*$  2
- b) Convert the following DFA to Regular Expression. 4

	0	1
p	p	q
q	q	r
r	p	r

- c) Figure shows deterministic finite state automaton M. Let the set of seven bit binary strings whose 1st, 4th and the last bits are 1 is denoted by S. How many strings in S is accepted by M? 4



3. a) Explain ambiguous grammar  $G: E \rightarrow E + E \mid E * E \mid (E) \mid -E \mid id$  for the sentence  $id + id * id$ . 3
- b) Construct parse tree for the input string  $w = cad$  using top down parser. 4

$S \rightarrow cAd$   
 $A \rightarrow ab \mid a$

- c) What is the minimum number of states in any DFA accepting the regular language  $L = (111+11111)^*$ ? Explain. 3

4. a) Describe the languages denoted by the following regular expressions: 5  
 i.  $a(a|b)^*a$       ii.  $((\epsilon|a)b^*)^*$

- b) Construct a syntax directed definition for constructing a syntax tree for assignment statements. 5

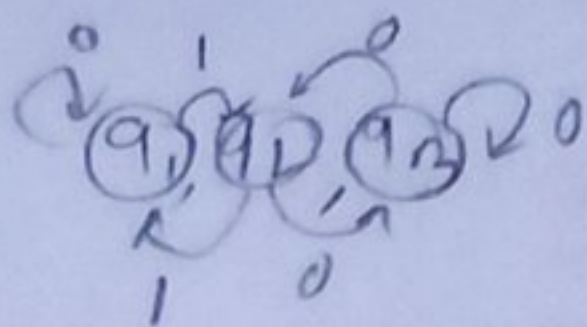
$S \rightarrow id := E$   
 $E \rightarrow E1 + E2$   
 $E \rightarrow E1 * E2$   
 $E \rightarrow E1$   
 $E \rightarrow (E1)$   
 $E \rightarrow id$

5. a) Consider the context-free grammar: 6  
 $S \rightarrow SS + \mid SS * \mid a$   
 and the string  $aa + a^*$ .  
 i. Give the rightmost derivation for the string.  
 ii. Give a parse tree for the string.  
 iii. Is the grammar ambiguous or not? Justify your answer.

- b) Show that the following grammar 4  
 $S \rightarrow Aa \mid bAc \mid dc \mid bda$   
 $A \rightarrow a$   
 is LR (1) but not SLR (1)

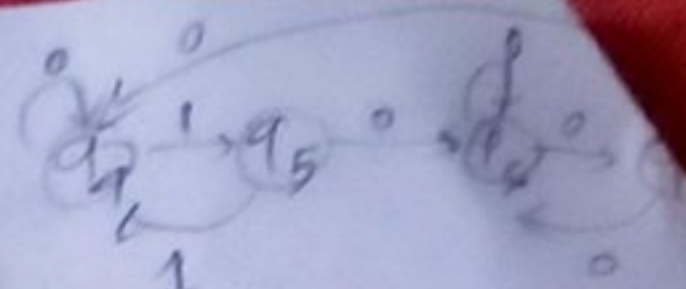
6. a) Check whether the following two DFA's are equal or not. 4





	0	1
q1	q1	q2
q2	q3	q1
q3	q2	q3

	0	1
q4	q4	q5
q5	q6	q4
q6	q7	q6
q7	q6	q4



- b) Construct parsing table for the grammar and find moves made by predictive parser on input  $id + id * id$  and find FIRST and FOLLOW.

$E \rightarrow E + T$

$E \rightarrow T$

$T \rightarrow T * F$

$T \rightarrow F$

$F \rightarrow (E)/id$

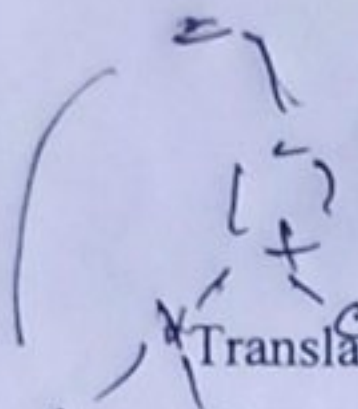
7. a) Given the following code segment:

for  $i:=1$  to 20 do

if  $i > a+5$

then  $x:=x+2$

else  $y:=y-1$ ;



Translate the code segment into abstract syntax trees, quadruples, and postfix code.

- b) Consider the following grammar:

$S \rightarrow A$

$A \rightarrow A+A \mid B++$

$B \rightarrow y$

- i) Draw the parse tree for the input " $y + + + y + +$ "  
 ii) Show a leftmost derivation of " $y + + + y + +$ "  
 c) Find the instruction cost for the following instructions.

(i) MOV R0, R1

ADD c, R0

MOV R0, a

(ii) MOV 4(R0), M

MOV b, a(R)

8. a) Draw the DAG for the statement  $a=(a*b+c)-(a*b+c)$ .

- b) For the following three address code identify the basic blocks and draw the flow graph.

```

(1) PROD = 0
(2) I = 1
(3) T2 = addr(A) - 4
(4) T4 = addr(B) - 4
(5) T1 = 4 x I
(6) T3 = T2[T1]
(7) T5 = T4[T1]
(8) T6 = T3 x T5
(9) PROD = PROD + T6
(10) I = I + 1
(11) IF I <= 20 GOTO (5)
  
```

- c) Optimize the following code:

```

while(i<100)
{
  a = Sin(x)/Cos(x) + i;
  i++;
}
  
```



# Bangabandhu Sheikh Mujibur Rahman Science and Technology University

## Department of Computer Science and Engineering

### 3<sup>rd</sup> Year 1<sup>st</sup> Semester B.Sc. Engineering Final Examination 2019

Course Title: Computer Architecture and Organization

Course Code: CSE 305

Total Marks: 60

Time: 3 (Three) Hours

N.B.

- i. Answer **SIX** questions taking any **EIGHT**.
- ii. All questions are of equal values.

1. a) Show the binary representation of  $-0.125_{10}$  in single and double precision. 2  
b) Draw the block diagram of a four-way set associative cache. 3  
c) Write down the control steps including control signals in a multi (three) bus organization for the following instruction- ADD R4, R5, R6. 3  
d) Write short note on (i) Control word (ii)  $\mu$ instructions (ii)  $\mu$ PC. 2
2. a) What is instruction pipeline? How does it improve the performance of computer system? Explain with diagram. 3  
b) Explain user visible and status register with example. 3  
c) What is memory hierarchy? Explain. 2  
d) What is meant by branch penalty? Discuss the various approaches for dealing with branches. 2
3. a) Assume (i) 1 memory bus clock cycles to send the address (ii) 10 memory bus clock cycles each DRAM access initiated (iii) 2 memory bus clock cycles to send a word of data. Now analyze miss penalty for the following memory organizations- (i) One-word-wide memory (ii) Wide memory (iii) Interleaved memory organization. 3  
b) Describe following block placement mechanism in cache and analyze performance in terms of number of misses- (i) Fully associative (ii) Set-associative (iii) Direct-mapped. 3  
c) Draw the improved version of multiplication hardware. 2  
d) Define main memory. How many semiconductor cells are in a 4GB RAM? 2
4. a) Describe how virtual memory, TLB and cache work together with necessary figures. 3  
b) A program runs in 8 seconds on computer A, which has a 4GHz clock. You want to help a computer designer build a computer B that will run this program in 6 seconds. The designer has determined that a substantial increase in the clock rate is possible, but this increase will affect the rest of CPU design, causing B to require 1.2 times clock cycles as computer A for this program. What clock rate should you tell the designer to target? 2  
c) Describe following methods of handling instruction hazard due to conditional branch- (i) Delayed Branch (ii) Branch Prediction 3  
d) What is swapping? How virtual page number is mapped to secondary memory when page fault occurs? 2



5. a) Draw a flow chart of processing a read or write through in TLB and cache. 3
- b) A compiler designer is trying to decide between two code sequences for a particular computer. The hardware designers have supplied the fact in fig-1(a). For a particular high-level-language statement, the compiler writer is considered two code sequences that require the instructions counts in fig-1(b). Which code sequence executes the most instructions? Which will be faster? What is the CPI for each sequence? 3
- c) Write down the division algorithm and draw the division hardware. 2
- d) Write short note on (i) hit (ii) miss (iii) hit time (iv) miss penalty. 2
6. a) Draw the block diagram of single bus organization with in processor. 2
- b) What is interrupt? Briefly describe interrupt hardware. 2
- c) What is virtual memory? Why virtual memory is so important? How virtual address is translated to physical address? 3
- d) What is page table? Describe how page table is indexed with the virtual page number to obtain corresponding physical page number with necessary figures. 3
7. a) What is TLB? How TLB makes virtual memory translation fast? 3
- b) Verify the following statement with necessary reasoning- Increase in performance resulting from pipelining is proportional to the number of pipelining stages 3
- c) What is Computer Architecture? Describe overall operation of a computer. 2
- d) Write short note on (i) Throughput (ii) Response time (iii) Performance. 2
8. a) What is DMA? Explain DMA data transfer procedure using appropriate figure. 3
- b) Explain operating principle of a static RAM with necessary figure. 4
- c) What is cache memory? How does it minimize gap between CPU and RAM? 3



Full Marks: 60

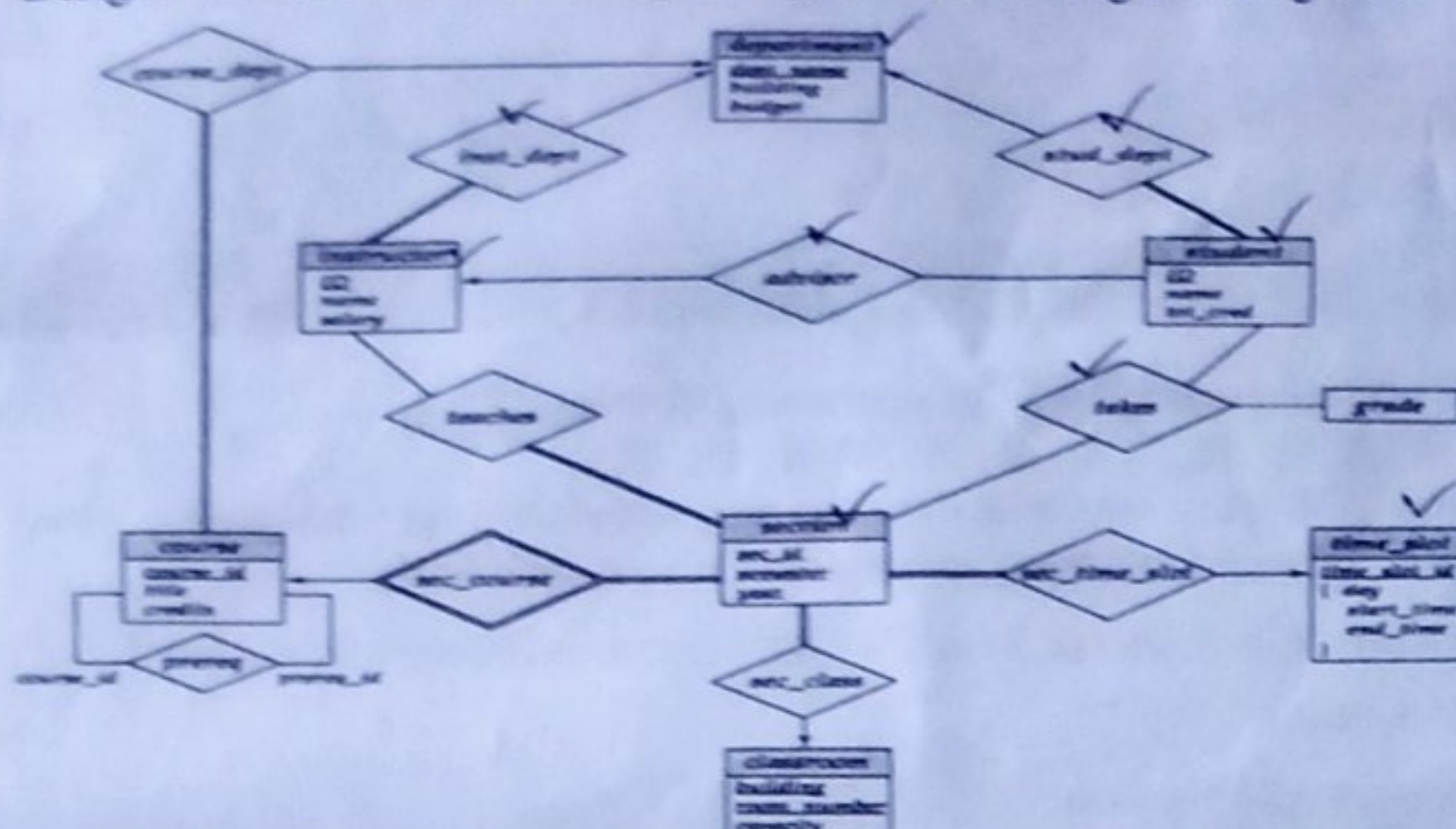
Times: 3 Hours

N.B.:

i. Answer any SIX questions.

ii. All questions are of equal values

1. a) Distinguish between the DDL and DML with example. 3
- b) Who is database administrator? Write down the function of database administrator. 3
- c) Explain in detail about Database Management System advantages over file management system. 4
2. a) Design a relation database corresponding to the following E-R diagram. 5



- b) Construct an ER diagram for university registrar's office. The office maintains data about 5 each class, including the instructor, the enrollment and the time and place of the class meetings. For each student class pair a grade is recorded. Determine the entities and relationships.

3. a) Discuss various types of fundamental relational algebra operations in binary operations. 5
- b) Suppose you are given the following requirements for a simple database for the National Hockey League (NHL):
  - the NHL has many teams,
  - each team has a name, a city, a coach, a captain, and a set of players,
  - each player belongs to only one team,
  - each player has a name, a position (such as left wing or goalie), a skill level, and a set of injury records,
  - a team captain is also a player,
  - a game is played between two teams (referred to as host\_team and guest\_team) and has a date (such as May 25th, 2018) and a score (such as 4 to 2).

Construct a clean and concise ER diagram for the NHL database.

4. a) Illustrate the usage with example of SQL GROUP BY, ORDER BY and HAVING clauses. 5
- b) Consider the relational database of Figure-4, where the primary keys are underlined. 5

TRAIN (Name, Start, Destination)  
 TICKET (PNR\_NO, Start, Destination, Fare)  
 PASSENGER (Name, Address, PNR\_NO)

Figure-4: Database schemas.

Write SQL expressions for the following queries:

- i) List the names of passengers who are travelling from the start to the destination station of the train.
  - ii) Change the destination address of "ABC Express" to "Rangpur".
- (11) Find the name of all passengers whose address includes the substring "Rangpur".



5. a) What is Database Normalization? Explain its role in database design. 3
- b) What do you know about functional dependency and data redundancy? 2
- c) The following figure 5
- i) What Normal Form did it violate?
- ii) How should we normalized the above table?

EmployeeID	Lastname	Firstname	DepartmentCode
1001	Mills	Karen	SAL01
1002	Courtney	Francis	SAL02
1003	Smith	Phillip	ENG01
1005	Xavier	Duran	ENG02
1004	Morrison	John	SAL02

6. a) The following set of key values are given for constructing B<sup>+</sup>-tree: 4  
 (3, 10, 17, 23, 28, 31, 41, 45, 51, 59, 61, 65, 70)  
 Assume that the tree is initially empty and values are added in ascending order. Now construct B<sup>+</sup> -tree such that maximum three pointers are fitted in each node.
- b) What is Redundant Array of Independent Disks(RAID)? Discuss different levels of RAID. 6
7. a) What is Thomas' Write Rule? 2
- b) Explain the Timestamp-Based Protocols. 5
- c) Differentiate between homogeneous and heterogeneous database system. 3
8. a) During the execution, a transaction passes through several states. Draw the state diagram of 4  
 transaction and define each of them briefly.
- b) Describe several architectural models for parallel machines. 6



**Bangabandhu Sheikh Mujibur Rahman Science & Technology University**  
**Department of Computer Science and Engineering**  
**3<sup>rd</sup> year 1<sup>st</sup> Semester B. Sc Engineering Final Examination-2019**

**Course Code:** CSE301

**Time:** 3 hours

**N.B.** Answer any six out of eight Questions

**Course Title:** System Analysis & Design

**Total Marks:** 60

1. (a) What is a system? Write down the constraints of a system. 3  
 (b) What do you mean by information? Briefly explain about categories of information. 3  
 (c) Write short notes on: 4
  - i. Physical vs Abstract system
  - ii. Adaptive vs Non-Adaptive system
  - iii. Deterministic vs Probabilistic system
  - iv. Natural vs Manufactured system
2. (a) What is prototyping? Write the basic steps of prototyping. What are the advantages of it? 4  
 (b) What are the reasons for which system does not meet user requirements? 2  
 (c) Write down the basic differences between structured and unstructured interview. 2  
 (d) Define Joint Application Development. What are the advantages of it? 2
3. (a) What is feasibility study? Describe about different types of feasibilities in SDLC. 4  
 (b) What is system design? Differentiate physical and logical design of a system. 3  
 (c) Define entity, relationship and attributes in terms of E-R model. 3
4. (a) What is file? How many types of files are used in an organization system? 3  
 (b) Differentiate between sequential and random file access with examples. 2  
 (c) Define on-site observation. What are the types of observation method in case of human observer? 3  
 (d) Why is it important that an analyst learns about an organization's policies and objectives? 2
5. (a) Briefly explain the key considerations in feasibility analysis. 3  
 (b) Why is it difficult to determine user requirements? Illustrate. 3  
 (c) Mention what are the skills required to become a computer analyst? 2  
 (d) Differentiate black box and white box testing. 2
6. (a) Describe the break-even analysis with figure. 3  
 (b) Write down the advantages and disadvantages of Interview. 3  
 (c) Briefly discuss: i) Logical and physical design ii) Coupling and cohesive iii) HIPO and IPO 2  
 (d) Briefly explain about 4 P's in project management. 2
7. (a) What is risk management? Briefly describe risk management process in project management. 5  
 (b) Write down the benefits of use-case modelling. 3  
 (c) Write short notes about basic use-case symbols. 2
8. (a) What is normalization? What is the purpose behind it? How does one normalize a file? Illustrate. 2  
 (b) What do you mean by quality assurance and quality control? 2  
 (c) What is system development life cycle? Briefly describe the steps of is system development life cycle. 2  
 (d) What is software re-engineering? Write short notes on: 4
  - i. Corrective software maintenance
  - ii. Adaptive software maintenance
  - iii. Perfective software maintenance
  - iv. Preventive software maintenance



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**3<sup>rd</sup> year 1<sup>st</sup> Semester B. Sc Engineering Final Examination-2019**

**Course Code:** CSE303

**Time:** 3 hours

**Course Title:** Operating System & System Programming

**Total Marks:** 60

**N.B.** Answer any **SIX** out of **EIGHT** questions

1. (a) What is kernel in an operating system? Briefly explain dual mode operation in OS. 2
- (b) What is spooling? Do you think that advanced personal computers will have spooling as a standard feature in the future? 2
- (c) Find the average waiting time, turnaround time and completion time for each of the following processes using Priority scheduling (pre-emptive). 3

Process-id	Arrival time	Burst time	Priority
P1	0	1	2
P2	1	7	6
P3	2	3	3
P4	3	6	5
P5	4	5	4
P6	5	15	10
P7	15	8	9

- (d) Define the following terms with examples: 3
  - i. Batch OS
  - ii. Real Time OS
  - iii. Context Switching

2. (a) Given memory partitions of 100 KB, 500 KB, 200 KB and 300 KB. How would each of the first fit, best fit and worst fit algorithm place processes of 212 KB, 417 KB, 112KB and 412 KB (in order)? Which algorithms make the most efficient use of memory? 4

- (b) Consider the following segment table: 4

Segment	Base	Length
0	219	600
1	2300	14
2	90	100
3	1327	580
4	1952	96

What are the physical addresses of the following logical addresses?

0, 430 b) 1, 10 c) 2, 500 d) 3, 400 e) 4, 112

- (c) What are the differences between a trap and an interrupt? 2

3. (a) What is convoy effect? Describe a scenario with convoy effect and also find out the solution to get rid from convoy effect. 3

- (b) Briefly explain a scenario when Round Robin scheduling works as First Come First Serve scheduling. 3

- (c) Find the average waiting time, turnaround time, response time and completion time for each of the following processes using Multi-Level Feedback Queue Scheduling. 3

Q1=Round Robin (Time quantum=17)

Q2=Round Robin (Time quantum=25)

Q3=FCFS

Q1>Q2>Q3

Process-id	Arrival time	Burst time
P1	0	53
P2	0	17
P3	0	68
P4	0	24

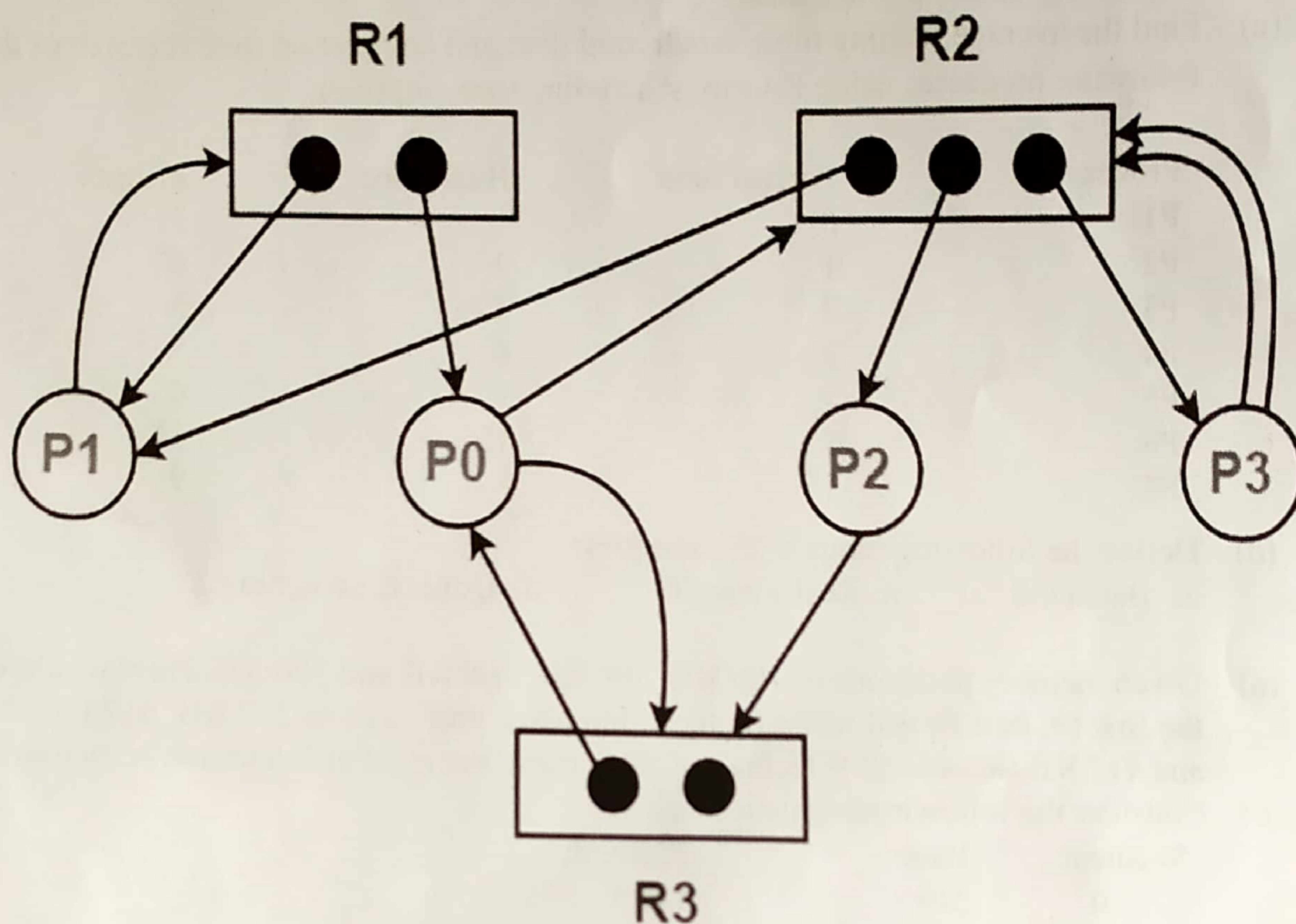
- (d) Write down the key differences between Scheduler and Dispatcher. 1

4. (a) Consider the following set of processes with the length of the CPU burst time given in milliseconds: 5

Process	Burst Time	Priority	Arrival Time
P1	10	3	0
P2	1	1	1
P3	2	3	2
P4	1	4	3
P5	5	2	4



- i) Draw Grantt charts illustrating the execution of these processes using FCFS, SJF and non-preemptive priority scheduling. 3
    - ii) What is the turnaround time and waiting time for each of the scheduling? 2
  - (b) How deadlocks can be eliminated using resource preemptive? 3
  - (c) Draw the diagram of process state. 2
- 5.
- (a) What is process synchronization? Briefly explain the producer-consumer problem using necessary code. 4
  - (b) What is deadlock? Write down the necessary conditions for deadlock. 3
  - (c) What is RAG in OS? Consider the RAG and find if the system is in a deadlock state otherwise find a safe sequence. 3



6.
  - (a) Give two real life example of deadlock. 2
  - (b) What is the circular wait condition for deadlock? Give an idea to avoid the circular wait. 2
  - (c) Here the sets of P, R and E.  
 $P = \{P_1, P_2, P_3\}$ ,  $R = \{R_1, R_2, R_3, R_4\}$ ,  $E = \{P_1 \rightarrow R_1, P_2 \rightarrow R_3, R_1 \rightarrow P_2, R_2 \rightarrow P_2, R_2 \rightarrow P_1 \text{ and } R_3 \rightarrow P_3\}$  4  
 Now draw the resource allocation graph and wait for graph.
  - (d) What is safe state or safe sequence? Define briefly. 2
7.
  - (a) Define degree of multiprogramming. How degree of multiprogramming can be increased - explain with examples. 2
  - (b) Write down the differences between static and variable partitioning in memory management. 3
  - (c) Briefly explain a scenario that illustrate the concept of internal and external fragmentation. 3
  - (d) Differentiate contiguous and non-contiguous memory allocation. 2
8.
  - (a) Define virtual memory. How it works? 3
  - (b) Consider a reference string: 7, 0, 1, 2, 0, 3, 0, 4, 2, 3, 0, 3, 2, 1, 2, 0, 1, 7, 0, 1 the number of frames in the memory is 4. Find out the number of page faults respective to: 5
    - i. Optimal page replacement
    - ii. Least recently used
  - (c) What is context switching? When does context switching happen? 2