

University of Rajshahi
Department of Computer Science and Engineering
B. Sc. (Engg.) Part-III, Odd Semester, Examination 2021
Course: CSE 3111 (System Analysis & Design)
Full Marks: 52.5 Time: 3 Hours
[Answer six (06) questions taking any three from each section]

Section A

- ✓ 1. a) Distinguish between a Physical and Abstract system. 2
b) What are the elements of a system? Can you have a viable system without feedback? Explain. 2.75
c) Discuss the primary characteristics of open systems. In what way is a system entropic? 4
- ✓ 2. a) Write down the internal and external factors which initiate or influence the change in a system. Give examples where necessary. 2.75
b) Write down the probable reasons your project may be terminated or become a failure. 3
c) What are the considerations that act as important factors in deciding a candidate system? Discuss briefly. 3
- ✓ 3. a) What are the technical and interpersonal skills required of systems analysts? 3
b) Draw a figure and explain which skill is favored over the other in the following stages and why: i. Analysis; ii. Design; iii. Implementation; iv. Maintenance. 2.75
c) Discuss the role of the system analyst as a "Change Agent", "Psychologist" and "Motivator". 3
4. a) Assume as a user you noticed a problem or an area of improvement in the current system. What will be your steps in informing the authority about it and bring a change in the system? 3
b) Discuss the problems of Human bias in data selection and use. 3.75
c) Explain the expectancy theory of user motivation in your own words. 2

Section B

- ✓ 5. a) What is a structured analysis? State the disadvantages of traditional approach to system analysis. 2
b) Discuss the concept and procedure used in constructing DFD with an example. 3.75
c) Define data dictionary. How it overcomes the limitations of DFD? What are the disadvantages of data dictionary? 3
- ✓ 6. a) Suppose a group of 12 people including you who work on a system are scheduled for interviewing by an analyst. What would you expect from him while he conducts the interviewing process? 4.25
b) Explain the difference between structured and unstructured interviewing. 2
c) In which ways Questionnaire is a better information gathering tool than interviewing? 2.5
7. a) What are the three key questions of the feasibility study? 2
b) What sections are contained in the feasibility report? Explain elaborately. 3.75
c) What do you mean by data dictionary? Write down some advantages and disadvantages of data dictionary. 3
- ✓ 8. a) Discuss the concept of Structured design. 2.75
b) Distinguish between logical and physical design. 3
c) Define coupling, Module coupling and Module cohesion. 3

[Answer three questions from each part]

Part A

- 1(a) Explain, what are the difficulties you may face to manage students records in a *Microsoft Excel* sheet? 2.5
 - (b) Explain different Levels of *Abstraction* of a Databases Management System? 3.75
 - (c) What are *Instances* and *Schemas* of Databases Management System? Explain with examples. 2.5
- 2(a) Do you find any problem with the relationship shown in Fig 2.1? Explain your answer. 3
 - (b) Replace the *Ternary* relationship shown in Fig 2.2 with *Binary* relationship. Explain your idea. 3

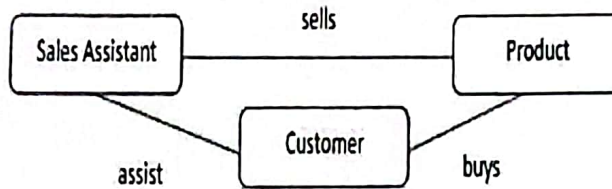


Fig 2.1

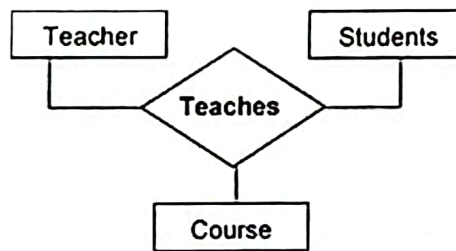


Fig 2.2

- (c) What is *Strong Entity set*? What are the problems of a *Weak Entity set*? 2.75
- 3(a) How can you form tables for *Entity set/Relationship set* from the following ER diagram (Fig 3.1 ~ Fig 3.4). Form the table(s) and explain your approaches. 6

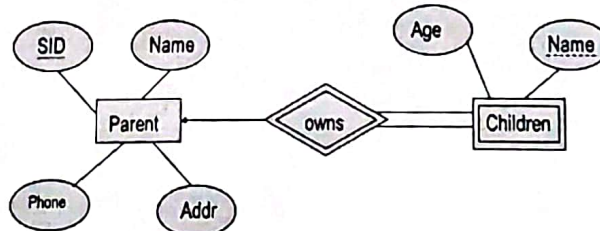


Fig 3.1

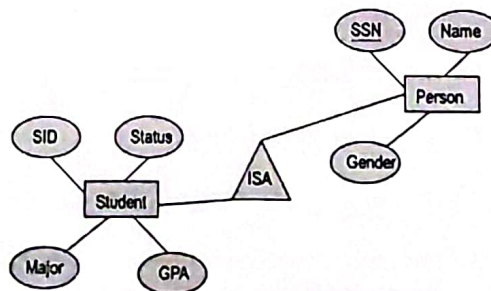


Fig 3.2

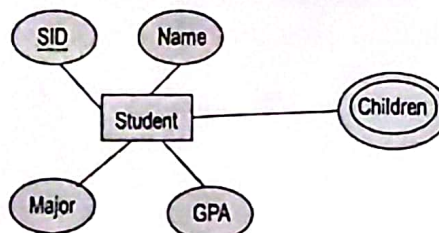


Fig 3.3

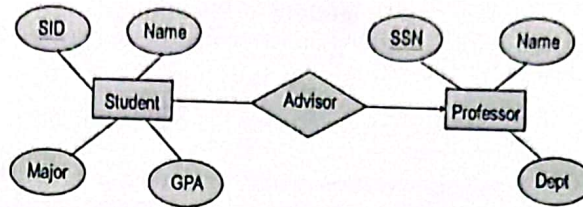


Fig 3.4

- (b) What are tests those must be made to preserve the following referential integrity constraint $\Pi_K(r_1) \subseteq \Pi_K(r_2)$ for *Insert* and *Update* operations. 2.75

- 4(a) What will happen when *Triggers* are called in a cascading nature? 1.25
 (b) What do you understand by the *Authorization Graph* shown in Fig. 4.1 1

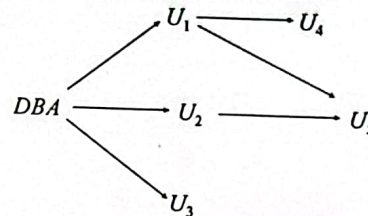


Fig. 4.1

- (c) Write an expression in relational algebra (consider the relations given below). 4.5
 (i) to find the loan number for each loan of an amount greater than \$1200
 (ii) to find out the customers of the bank who have a loan but not an account
 (iii) to find the names of all customers who have a loan at the *Perryridge* branch.
 (iv) to find the largest account balance in the bank
 (d) Write an expression in relational algebra to find out all customers who have an account at all the branches located in *Brooklyn* (consider the relations given below). 2

customer_name	loan_number
Adams	L-16
Curry	L-93
Hayes	L-15
Jackson	L-14
Jones	L-17
Smith	L-11
Smith	L-23
Williams	L-17

✓ borrower

customer_name	account-number
Hayes	A-102
Johnson	A-101
Johnson	A-201
Jones	A-217
Lindsay	A-222
Smith	A-215
Turner	A-305

✓ depositor

account-number	branch-name	balance
A-101	Downtown	500
A-102	Perryridge	400
A-201	Brighton	900
A-215	Mianus	700
A-217	Brighton	750
A-222	Redwood	700
A-305	Round Hill	350

↑ account

loan_number	branch_name	amount
L-11	Round Hill	900
L-14	Downtown	1500
L-15	Perryridge	1500
L-16	Perryridge	1300
L-17	Downtown	1000
L-23	Redwood	2000
L-93	Mianus	500

↗ loan

Part B

- 5(a) Briefly discuss how '%', '_' and 'like' be used in SQL statement to search for string data? Give example 2.75
 (b) Consider the relations given below, and write SQL statements for the following queries. 6
 (i) Find the names, streets and cities of residence of all employees who work for "Sonali" and earn more than 1,20,000 per annum.
 (ii) Find all employees in the database who live in the same cities and on the same streets as do their managers.
 (iii) Find those companies whose employees earn a higher salary, on average, than the average salary at "Agrani" Bank.
 (iv) Give all managers a 10 percent salary raise unless salary becomes greater than 19,000; in such cases, give only a 3 percent salary raise.
 (v) Show the 'works' relation instance after executing (iv).

Employee		
eName	Street	City
Arif	51 west	Rajshahi
Sumon	52 east	Moynamati
Sagor	Neemgachhi	Siralgong
Abdul	Binodpur	Rajshahi
Himesh	Nazrul ave	Dhaka
Amirul	Chawk bazar	Sylhet
Saib	99 north	Chittagong

Works		
eName	cName	salary
Sumon	Agrani	12000
Abdul	Sonali	13000
Himesh	Agrani	6000
Amirul	Sonali	20000
Sagor	Sonali	8000
Arif	Janata	18000

Manages	
eName	mName
Amirul	Amirul
Abdul	Amirul
Sagor	Amirul
Sumon	Sumon
Himesh	Sumon
Arif	Arif

company	
cName	city
Agrani	Rajshahi
Sonali	Sylhet
Janata	Dhaka

- 6(a) What are the advantages, (i) RAID level 5 over RAID level 4 and (ii) RAID level 4 over RAID level 3? 2
- (b) For the following two schedules shown in Fig. 6.1 and Fig. 6.2, by applying necessary swapping of non-conflicting instructions, prove that these are conflict equivalent. 3.5
- (c) Is the schedule shown in Fig. 6.3 consistency preserving? Explain your answer. 3.25

T ₁	T ₂
read(A)	
write(A)	
	read(A)
	write(A)
read(B)	
write(B)	
	read(B)
	write(B)

Fig. 6.1

T ₁	T ₂
read(A)	
write(A)	
read(B)	
write(B)	
	read(A)
	write(A)
	read(B)
	write(B)

Fig. 6.2

T ₁	T ₂
read(A)	
A := A - 50	
	read(A)
	temp := A * 0.1
	A := A - temp
	write(A)
	read(B)
write(A)	
read(B)	
B := B + 50	
write(B)	
	B := B + temp
	write(B)

Fig. 6.3

- 7(a) For $R = (A, B, C)$, $F = \{A \rightarrow B, B \rightarrow C\}$, if R is decomposed in (i) $R_1 = (A, B)$, $R_2 = (B, C)$ and (ii) $R_1 = (A, B)$, $R_2 = (A, C)$, then explain whether they are *Lossless-join decomposition* or not. 2.5
- (b) Let, set of Functional Dependencies $F = \{A \rightarrow BC, CD \rightarrow E, E \rightarrow C, D \rightarrow AEH, ABH \rightarrow BD, DH \rightarrow BCA\}$. Check if $BCD \rightarrow H$ is true or not. 2
- (c) Let, $R = (A, B, C)$, $F = \{A \rightarrow BC, B \rightarrow C, A \rightarrow B, B \rightarrow C\}$. Find out Canonical Cover and then the *Candidate key/Primary key*. 4.25
- 8(a) For following relations as shown in Fig. 8.1 ~ Fig. 8.3, find set of Functional Dependencies for those three relations. If Fig. 8.2 and Fig. 8.3 are decomposed from Fig. 8.1, is the decomposition dependency preserving? Explain your answer. 3.5

A	B	C
1	1	1
2	1	2
3	2	1
4	2	2

Fig. 8.1

A	B
1	1
2	1
3	2
4	2

Fig. 8.2

B	C
1	1
1	2
2	1
2	2

Fig. 8.3

- (b) Let $R = (ABCDE)$, set of Functional Dependencies $F = \{A \rightarrow B, B \rightarrow C, C \rightarrow D, D \rightarrow A\}$. Let R is decomposed as $R_1 = (ABC)$ and $R_2 = (CDE)$, prove that this decomposition is *dependency preserving*. 5.25

(Answer Six questions taking Three questions from each Section)

Section-A

1. a) Define digital signal processing. Discuss the advantages and limitations of digital signal processing. 2
 b) What is Nyquist rate? What is the Nyquist rate of the analog signal $x_a(t) = 3\cos 50\omega t + 10\sin 300\omega t - \cos 100\omega t$? 3
 c) What is the difference between unit sample and unit step sequences? Show the graphical presentation of the signal $x(-n)$ and $x(-n+2)$, where $x(n)$ is a unit step sequence. 3.75
2. a) What is the significance of impulse response $h(n)$ of a system? Find the output $y(n)$ of the system if input $x(n) = \{1, 0, 1, 1\}$ and impulse response $h(n) = a^n u(n)$, $|a| < 1$. 3
 b) What is the difference between the cross-correlation and the convolution? Say $x(n) = \{1, 2, 3, 1\}$, Show that at 0 lag correlation value is maximum. 3
 c) Show that convolution in one domain (e.g., time domain) equals point-wise multiplication in the other domain (e.g., frequency domain). 2.75
3. a) How Difference equations are used for characterizing the response of LSI systems- explain 3
 b) A Digital Filter is defined by the difference equation $y(n) = 0.95 y(n-1) + x(n)$, (i) determine the transfer function (ii) Would you classify it as Low Pass, Band Pass ... or what? 2.75
 c) A function $f(x)$ is periodic if for a constant $T > 0$, $f(x + T) = f(x)$. Express $f(x)$ as an infinite sum of sine and cosine functions. Find Fourier coefficients of the square wave function $f(x)$ defined by $f(x) = \begin{cases} 0 & \text{if } -\pi \leq x < 0 \\ 1 & \text{if } 0 \leq x < \pi \end{cases}$ and $f(x + 2\pi) = f(x)$ 3
4. a) Why do we use Fourier transform? Find Fourier transform of $\delta(t)$ and draw the spectrum. 3
 b) Define Z-transform. Show that DTFT $[x(n)] = Z[x(n)]_{z=1}$ 2.75
 c) The region of convergence (ROC) of $X(z)$ is the set of all values of z for which $X(z)$ attains a finite value. Find ROC of the following expression $x(n) = 0.5^n u(n) + 0.8^n u(-n-1)$ 3

$20, -3-j-2\sqrt{2}-\sqrt{2}j, 0$
 $- + + -$

Section-B

5. a) Define the symmetry and time shift properties of DFT with example 3
 b) Find the DFT of the following sequence, $x(n) = \begin{cases} 1 & \text{for } 0 \leq n < 2 \\ 0 & \text{otherwise} \end{cases}$ 3
 (i) For $N=4$ (ii) Plot $|X(K)|$ and $\angle X(K)$
 c) Define spectral leakage. How windowing can help reduce the bad effects of spectral leakage. 2.75
6. a) What are twiddle factors? Why do we use twiddle factors? Calculate the values of the following twiddle factors for a 4-point DFT: $W_4^0, W_4^1, W_4^2, W_4^3, W_4^4$ 3.75
 b) Draw the DIT-FFT flow diagram for an 8 point FFT and obtain the FFT of the sequence $x(n) = [1, 2, 3, 4, 4, 3, 2, 1]$. 5
7. a) What does the transfer function of a filter mean? Derive the transfer function of FIR and IIR filters. 3
 b) Show that the following expression presents a low pass FIR filter $y(n) = x(n) + 2x(n-1) + x(n-2)$ 3
 c) Determine the Direct form- I and Direct form- II realization for the following system $y(n) = 0.5y(n-1) - 0.25y(n-2) + x(n) + 0.4x(n-1)$ 2.75
8. a) What is aliasing effect? Why do we need anti-aliasing filter in signal processing? 2
 b) Consider the analog signal $x_a(t) = 10 \sin 350\pi t + 25 \cos 400\pi t - 15 \cos 450\pi t$. Determine the sampling rate to avoid aliasing and maximum magnitude of the signal. 2.25
 c) Consider a continuous-time system which has input of signal $x(t)$ and output $y(t) = x(t)u(t)$. Is this system time invariant and linear? Justify your answer. 4.5

University of Rajshahi
Department of Computer Science and Engineering
B.Sc. Engg, Part-III, Odd Semester, Examination-2021
Course: CSE3141 (Compiler Design)
Full Marks-52.5 Time: 3 hours

[N.B. Answer any **SIX** questions taking **THREE** from each of the sections]

Section-A

1. a) What is the difference between a compiler and interpreter? 2
b) Suppose a source program contains the assignment statement, 5
$$\text{position} = \text{initial} + \text{rate} * 60$$

Explain how this statement is processed and finally translated at different phases of a traditional compiler. 1.75
- c) Distinguish between single-pass and multi-pass compiler. 1.75
2. a) Define token and lexeme. What are the functions of lexical analyzer? 3
b) Explain the necessity of regular expression and context-free grammar in designing of a compiler. 2
c) Construct a lexical analyzer (i.e. DFA) for the regular expression: $(a|b)^*b(a|b)$. 3.75
3. a) Write down formal definition of grammar. Discuss Chomsky hierarchy of formal grammars. 3.75
b) Define normal Chomsky Form (CNF). Convert following CFG into Chomsky Normal Form : 5
i) $S \rightarrow ASaBA$ ii) $A \rightarrow B|S$ iii) $B \rightarrow b|e$
4. a) Define ambiguity of context-free grammar. Using disambiguation rule make the grammar unambiguous: 2.5
 $E \rightarrow (E) | E-E | E * E | E+E | id$
b) Define LL (1) grammar. Convert the above grammar into LL (1). Construct a predictive parsing table using the grammar. 6.25

Section-B

5. a) What is compiler? Define the types of compilers. 3
b) Briefly discuss the functional components of a compiler. 3.5
c) What is front end and back end of a compiler? Why the compilers' functional components (phases) should be divided? 2.25
6. a) What is bottom-up parsing? How it is implemented? 1.5
b) Construct an operator relation table for operator precedence parser for the following grammar: 2.25
 $E \rightarrow EAE | E | id, A \rightarrow + | *$
c) Check following grammar SLR(1) or not: $S \rightarrow T, T \rightarrow T * F | F, F \rightarrow id$. 5
7. a) Explain syntax-directed translation (SDT) scheme. 2
b) Write down SDT for following CFG: 4.5
 $S \rightarrow id = E, E \rightarrow E - T | T, T \rightarrow T / F | F, F \rightarrow id$

using the required SDT produce three-address code for the statement "x=a-b/c".
- c) Write down a postfix notation for the infix statement "if a then if c-d then a+c else a*c else a+b". 2.25
8. a) Define code optimization. What are the principal sources of optimization? Explain in detail. 3.75
b) What do you mean by local and global optimization? Shortly discuss these two phases of optimization. 5



SECTION A

ANSWER ANY THREE OF THE FOLLOWING

- 1.(a) What is Computer Network? How is it useful for business users? [2¼]
(b) Can you clarify the mechanism of the client-server model in the context of a computer network? [02]
(c) Distinguish between LAN and MAN. [02]
(d) Define protocol and protocol stack. In the context of network architecture, what is known as Peer? [02]
- 2.(a) Describe the ARPANET structure. [3¼]
(b) What do you know about the primary concern of the Physical Layer? [02]
(c) It is said that there exist three concepts that are considered to be the center of the OSI model. What do you know about those concepts? [03]
- 3.(a) In the context of the Data link layer, what is known as framing? [02]
(b) What is meant by the term CSMA? Can you explain the working principle of the 1-Persistent CSMA protocol? [02]
(c) Explain the token ring as a collision-free protocol. [3¼]
(d) Elaborate MAC. Define the role of this sublayer in short. [01]
- 4.(a) Why do we use public and private addresses? [2¼]
(b) How can you find out root bridge for a VLAN? [02]
(c) How can you configure a network address translator (NAT) device? [2¼]
(d) What are the differences between NAT and PAT? [02]

SECTION B

ANSWER ANY THREE OF THE FOLLOWING

- 5.(a) Assume that the sender and receiver agreed with a common CRC generator binary sequence as 1011. The sender wants to send a message with a binary sequence: 1110011. Now generate the data that's to be sent with CRC bits and show the calculation of checking successful transmission at the receiver end. [3¼]
(b) "Errors can be of three types" – what are they? [02]
(c) Can you explain the two-dimensional parity check mechanism with a suitable example? [03]
- 6.(a) Explain the "Simple Stop and Wait ARQ" protocols' working principle. [03]
(b) Can you distinguish between Go back N ARQ and Selective Reject ARQ? [2¼]
(c) Give us some idea about the HDLC frame structure. [03]
- 7.(a) What is meant by address space? [02]
(b) How can we find the class of an IPv4 address? What is the default mask of class A, B, and, C networks? [2¼]
(c) Assume that a company is granted the site address 106.33.64.0 (class C). The company needs eight subnets. Design the subnets. [02]
(d) What do you know about ARP and RARP? [02]
- 8.(a) Discuss flag bits with bit stuffing framing method. [03]
(b) How many bits are used to represent physical address, logical address and port address? [02]
(c) What is the problem of flooding? How can we prevent this problem? [3¼]