

Mid Term Examination
University of Dhaka
MATH: 3105 Multivariable Calculus and Geometry
Total: 40
Time: 1 Hour 30 Minutes

1. Show that $2\mathbf{i} + 2\mathbf{j} - \mathbf{k}$ is perpendicular to $5\mathbf{i} - 4\mathbf{j} + 2\mathbf{k}$. 3
2. In case of a vector space, what is the difference between the Standard basis and Nonstandard basis? 3
3. What do you mean by the column space (CS) and row space (RS) of a matrix? Let $T: R^5 \rightarrow R^4$ be defined by $T(\mathbf{x}) = A\mathbf{x}$, where \mathbf{x} is R^5 and 3+4

$$A = \begin{bmatrix} 1 & 2 & 0 & 1 & -1 \\ 2 & 1 & 3 & 1 & 0 \\ -1 & 0 & -2 & 0 & 1 \\ 0 & 0 & 0 & 2 & 8 \end{bmatrix}$$

4. Find the transition matrix from B to B' for the bases for R^3 below. 5
 $B = \{(1, 0, 0), (0, 1, 0), (0, 0, 1)\}$ and $B' = \{(1, 0, 1), (0, -1, 2), (2, 3, -5)\}$
5. Find parametric equations and symmetric equations of the line that passes through the points A (2, 4, -3) and B (3, -1, 1). 5
6. Find the angle between the planes $x + y + z = 1$ and $x - 2y + 3z = 1$. Also find the Find symmetric equations for the line of intersection of these two planes. 6
7. Consider the linear transformation $T: R^n \rightarrow R^m$ represented by $T(\mathbf{x}) = A\mathbf{x}$. Find the nullity and rank of T , and determine whether T is one-to-one, onto, or neither. 6

a. $A = \begin{bmatrix} 1 & 2 & 0 \\ 0 & 1 & 1 \\ 0 & 0 & 1 \end{bmatrix}$

b. $A = \begin{bmatrix} 1 & 2 \\ 0 & 1 \\ 0 & 0 \end{bmatrix}$

8. Find the null space of A, where 5

$$A = \begin{bmatrix} 1 & 1 & 0 & 0 & 1 \\ 0 & 0 & 1 & -2 & 0 \\ 4 & 2 & 0 & 0 & 3 \\ 1 & 1 & 1 & -2 & 1 \\ 2 & 2 & 0 & 0 & 2 \\ 1 & 1 & 2 & -4 & 1 \end{bmatrix}$$

University of Dhaka
Department of Computer Science and Engineering
Mid-Term Examination
3rd Year 1st Semester, Session: 2019-2020
CSE – 3104, Database Management System II

Total Marks: 30

Time: 1 Hour 30 Minutes

(Answer All of the following Questions)

1. a) How disks are organized in RAID level 5 (block-interleaved distributed parity)? What are the advantages of it? 2+1
 b) How RAID improves performance via parallelism? 2
 c) Consider a relational database with two relations: 3
 course (*course_name*, *room*, *instructor*)
 enrollment (*course_name*, *student_name*, *grade*)
 Define instances of these relations for 2 courses, each of which enrolls 3 students. Give the file structure of these relations that uses clustering.
2. a) “Secondary indices are always dense”. Explain 2
 b) Which index structure (ordered index or hashing) will be preferable in case of range queries and why? 2
 c) Classify hashing. Compare closed and open hashing. 1+3
 d) What are the advantages and disadvantages of extendable hashing over static hashing? 3
3. a) Suppose that a B+-tree index on *building* is available on relation *department*, and that no other index is available. What would be the best way to handle the following selections that involve negation? 3
 i) $\sigma_{\neg(\text{building} < \text{“Watson”})}(\text{department})$
 ii) $\sigma_{\neg(\text{building} = \text{“Watson”})}(\text{department})$
 iii) $\sigma_{\neg(\text{building} < \text{“Watson”} \vee \text{budget} < 50000)}(\text{department})$
 b) Suppose that a B+-tree index on (*dept_name*, *building*) is available on relation *department* (*dept_name*, *building*, *budget*). What would be the best way to handle the following selection? Explain. 1
 $\sigma_{(\text{building} < \text{“Watson”}) \wedge (\text{budget} < 55000) \wedge (\text{dept name} = \text{“Music”})}(\text{department})$
 c) How a join with disjunctive condition $r \bowtie_{\theta_1 \vee \theta_2 \vee \dots \vee \theta_n} s$ is evaluated? 2
4. Consider the following banking database: 2
 branch (*branch_name*, *branch_city*, *assets*)
 customer (*customer_id*, *customer_name*, *customer_city*)
 account (*account_number*, *branch_name*, *balance*)
 depositor (*customer_id*, *account_number*)
 a) Transform the following relational algebra expression to expression tree using equivalence rules to make it more efficient. 2
 $\Pi_{\text{customer_name}}(\sigma_{\text{branch_city} = \text{“Brooklyn”} \wedge \text{balance} > 100}(\text{branch} \bowtie (\text{account} \bowtie \text{depositor})))$
 b) Consider the join of *depositor* \bowtie *customer*, with *depositor* as the outer relation. Let *customer* have a primary B⁺-tree index on the join attribute *customer_id*, which contains 19 entries in each index node. If *customer* has 10,000 tuples and *depositor* has 5,000 tuples with a blocking factor f_r of 100 for both relations, what will be the query cost in terms of block accesses using the following joining strategies if 51 memory blocks are available for the task? 3
 i) block-nested loop join
 ii) Indexed-nested loop join

Scan the answer script with name, roll, course code and name on the top sheet, put page sequence number (x of y) in your answer script (a4 page recommended) and submit the scanned version with file name (roll_courseCode.pdf).

Answer any three of the following questions

1. Consider the following *buy a product* description. Customer browses catalog, selects items to buy and then goes to check out. Customer fills in shipping information (address, receive time). System presents full pricing information and customer fills in credit card information. System authorizes purchase, confirms sale and sends confirming email to customer. Draw a use case diagram for the above system. **10**
2. Identify functional and non-functional requirements of the following system. "A supermarket needs to develop software to encourage regular customers. For this, the customer needs to supply his name, address and telephone number. A customer is assigned a unique customer number (CN) by the computer. When a customer makes a purchase, the value of the purchase is credited against his CN. At the end of each year, surprise gifts to 10 customers who have made the highest purchase are given. In addition, gold coin is given to every customer who has made a purchase over Taka 80,000/- a month on an average." **10**
3. A company consists of departments. Departments are located in one or more offices. One office acts as headquarter. Each department has a manager who is recruited from the set of employees. Draw a class diagram with the classes in your system their attributes, operations and relationships. **10**
4. Coupling is the measure of the degree of interdependence between modules. Global data areas are commonly found in programming languages. Module A and module B have shared data. Making a change to the common data means tracing back to all the modules which access that data to evaluate the effect of change. **10**

What type of coupling occurs when module A changes data of module B or when control is passed? Explain with diagram.
5. Assuming one of your design goals is to *enable future developers to substitute the planning algorithm that decides on the next move with a better one* which design pattern would you consider to satisfy the goal? Explain your choice with a block diagrams. **10**

Incourse Exam (Special)
3rd year 1st Semester 2020
CSE3102: Computer Networks

Time: 1 Hour

Q1. Fig.1-3 show 2 packets (DNS) captured and analyzed by Wireshark. Answer the following questions: (10)

- What is the IP of the DNS server?
- What does the client want to know from the DNS server?
- Can you say whether the answers which the client gets was directly from DNS server's cache or not?
- You can see that there are multiple answers. Write down the significance of each answer.
- How can you tell whether the DNS response packet (Fig. 2, 3) is associated with the DNS query (Fig. 1) or not?

```
Internet Protocol Version 4, Src: 192.168.1.111, Dst: 8.8.8.8
  0100 .... = Version: 4
  .... 0101 = Header Length: 20 bytes (5)
  > Differentiated Services Field: 0x00 (DSCP: CS0, ECN: Not-ECT)
    Total Length: 54
    Identification: 0xc8a3 (51363)
  > Flags: 0x00
    Fragment Offset: 0
    Time to Live: 64
    Protocol: UDP (17)
    Header Checksum: 0xdfec [validation disabled]
    [Header checksum status: Unverified]
    Source Address: 192.168.1.111
    Destination Address: 8.8.8.8
User Datagram Protocol, Src Port: 60748, Dst Port: 53
  Source Port: 60748
  Destination Port: 53
  Length: 34
  Checksum: 0x9661 [unverified]
  [Checksum Status: Unverified]
  [Stream index: 27]
  > [Timestamps]
  UDP payload (26 bytes)
Domain Name System (query)
  Transaction ID: 0x6962
  > Flags: 0x0100 Standard query
  Questions: 1
  Answer RRs: 0
  Authority RRs: 0
  Additional RRs: 0
  Queries
    > du.ac.bd: type MX, class IN
0000  08 62 66 cd af f0 f4 5c 89 ba 7a d7 08 00 45 00  ·bf···\··z··E·
```

Fig. 1: Packet 1

```

> Frame 235: 247 bytes on wire (1976 bits), 247 bytes captured (1976 bits) on interface en0, id 0
> Ethernet II, Src: ASUSTekC_cd:af:f0 (08:62:66:cd:af:f0), Dst: Apple_ba:7a:d7 (f4:5c:89:ba:7a:d7)
✓ Internet Protocol Version 4, Src: 8.8.8.8, Dst: 192.168.1.111
    0100 .... = Version: 4
    .... 0101 = Header Length: 20 bytes (5)
    > Differentiated Services Field: 0x00 (DSCP: CS0, ECN: Not-ECT)
        Total Length: 233
        Identification: 0xab39 (43833)
    > Flags: 0x00
        Fragment Offset: 0
        Time to Live: 55
        Protocol: UDP (17)
        Header Checksum: 0x05a4 [validation disabled]
        [Header checksum status: Unverified]
        Source Address: 8.8.8.8
        Destination Address: 192.168.1.111
✓ User Datagram Protocol, Src Port: 53, Dst Port: 60748
    Source Port: 53
    Destination Port: 60748
    Length: 213
    Checksum: 0x1fb7 [unverified]
    [Checksum Status: Unverified]
    [Stream index: 27]
    > [Timestamps]
    UDP payload (205 bytes)
✓ Domain Name System (response)
    Transaction ID: 0x6962
    > Flags: 0x8180 Standard query response, No error
        Questions: 1
        Answer RRs: 7
        Authority RRs: 0
        Additional RRs: 0
    ✓ Queries
        > du.ac.bd: type MX, class IN
    ✓ Answers
        ✓ du.ac.bd: type MX, class IN, preference 30, mx aspmx2.googlemail.com
            Name: du.ac.bd
            Type: MX (Mail eXchange) (15)
            Class: IN (0x0001)
            Time to live: 1079 (17 minutes, 59 seconds)
            Data length: 25
            Preference: 30
            Mail Exchange: aspmx2.googlemail.com
        ✓ du.ac.bd: type MX, class IN, preference 10, mx aspmx.l.google.com
            Name: du.ac.bd
            Type: MX (Mail eXchange) (15)
            Class: IN (0x0001)
            Time to live: 1079 (17 minutes, 59 seconds)

```

Fig 2. Packet 2 (1/2)

	type: MX (Mail exchange) (15) Class: IN (0x0001) Time to live: 1079 (17 minutes, 59 seconds) Data length: 19 Preference: 10 Mail Exchange: aspmx.l.google.com
▼	du.ac.bd: type MX, class IN, preference 30, mx aspmx4.googlemail.com Name: du.ac.bd Type: MX (Mail eXchange) (15) Class: IN (0x0001) Time to live: 1079 (17 minutes, 59 seconds) Data length: 11 Preference: 30 Mail Exchange: aspmx4.googlemail.com
▼	du.ac.bd: type MX, class IN, preference 30, mx aspmx5.googlemail.com Name: du.ac.bd Type: MX (Mail eXchange) (15) Class: IN (0x0001) Time to live: 1079 (17 minutes, 59 seconds) Data length: 11 Preference: 30 Mail Exchange: aspmx5.googlemail.com
▼	du.ac.bd: type MX, class IN, preference 20, mx alt1.aspmx.l.google.com Name: du.ac.bd Type: MX (Mail eXchange) (15) Class: IN (0x0001) Time to live: 1079 (17 minutes, 59 seconds) Data length: 9 Preference: 20 Mail Exchange: alt1.aspmx.l.google.com
▼	du.ac.bd: type MX, class IN, preference 20, mx alt2.aspmx.l.google.com Name: du.ac.bd Type: MX (Mail eXchange) (15) Class: IN (0x0001) Time to live: 1079 (17 minutes, 59 seconds) Data length: 9 Preference: 20 Mail Exchange: alt2.aspmx.l.google.com
▼	du.ac.bd: type MX, class IN, preference 30, mx aspmx3.googlemail.com Name: du.ac.bd Type: MX (Mail eXchange) (15) Class: IN (0x0001) Time to live: 1079 (17 minutes, 59 seconds) Data length: 11 Preference: 30 Mail Exchange: aspmx3.googlemail.com
	[Request In: 234]
	[Time: 0.302072000 seconds]

Fig. 3: Packet 2 (2/2)

Q2. In order to prevent content piracy, some companies tend to disrupt P2P services by deploying decoys (i.e. misbehaving peers meant to disrupt downloads by other peers). Company A deployed a peer which advertises all chunks and sends fake content to others. On the other hand, company B deployed a peer which advertises all chunks but never sends any (fake or original) to others but repeatedly connects to other peers. Which method is more effective in disrupting P2P services and why?

(10)

Q3. Consider the delay introduced by the TCP slow-start phase. Consider a client and a Web server directly connected by one link of rate R . Suppose the client wants to retrieve an object whose size is exactly equal to $11S$, where S is the maximum segment size (MSS). The round-trip time between client and server is RTT (assumed to be constant). Ignoring protocol headers, determine the time to retrieve the object (including TCP connection establishment) when $S/R > RTT$. Show the packet exchange timing diagram. (10)

(১১/১১/১১)

University of Dhaka
Department of Computer Science and Engineering
Mid Term Examination 2020
Computer Networks

Full Marks: 30

1. IP is considered as a best-effort protocol? Comment on that. (2)
2. How does a local DNS server get the IP addresses of root DNS servers? (2)
3. What can you infer from the following *wireshark* screenshot: (5)

▼ Domain Name System (response)

Transaction ID: 0x7e28

► Flags: 0x8180 Standard query response, No error

Questions: 1

Answer RRs: 5

Authority RRs: 0

Additional RRs: 0

▼ Queries

▼ cse.du.ac.bd: type MX, class IN

Name: cse.du.ac.bd

[Name Length: 12]

[Label Count: 4]

Type: MX (Mail eXchange) (15)

Class: IN (0x0001)

▼ Answers

- cse.du.ac.bd: type MX, class IN, preference 10, mx ASPMX3.GOOGLEMAIL.COM
- cse.du.ac.bd: type MX, class IN, preference 1, mx ASPMX.L.GOOGLE.COM
- cse.du.ac.bd: type MX, class IN, preference 10, mx ASPMX2.GOOGLEMAIL.COM

Flags: 0x8180 Standard query response, No error
 Questions: 1
 Answer RRs: 5
 Authority RRs: 0
 Additional RRs: 0
 ▼ Queries
 ▼ cse.du.ac.bd: type MX, class IN
 Name: cse.du.ac.bd
 [Name Length: 12]
 [Label Count: 4]
 Type: MX (Mail eXchange) (15)
 Class: IN (0x0001)
 ▼ Answers
 ▶ cse.du.ac.bd: type MX, class IN, preference 10, mx ASPMX3.GOOGLEMAIL.COM
 ▶ cse.du.ac.bd: type MX, class IN, preference 1, mx ASPMX.L.GOOGLE.COM
 ▶ cse.du.ac.bd: type MX, class IN, preference 10, mx ASPMX2.GOOGLEMAIL.COM
 ▶ cse.du.ac.bd: type MX, class IN, preference 5, mx ALT2.ASPMX.L.GOOGLE.COM
 ▶ cse.du.ac.bd: type MX, class IN, preference 5, mx ALT1.ASPMX.L.GOOGLE.COM
 [Request In: 379]
 [Time: 0.170901000 seconds]
 0030 00 05 00 00 00 00 03 63 73 65 02 64 75 02 61 63c se·du·ac
 0040 02 62 64 00 00 0f 00 01 c0 0c 00 0f 00 01 00 00 ·bd·

4. Consider distributing a file of 20 Gbits to 12 peers. The server has an upload rate of 10 Mbps, and each peer has a download rate of 2 Mbps and an upload rate of 1 Mbps. Calculate the minimum distribution time for both client-server and P2P file distribution systems. (5)
5. What is the significance of the *bandwidth-delay product*? (2)
6. You are trying to debug your webserver settings. You used 'telnet' client to make a TCP connection at port 80 of gw.univdhaka.edu. When you typed 'GET / HTTP/1.0' and pressed the 'Enter' key twice, you got the following text:

```

HTTP/1.1 302 Found
Date: Tue, 08 Sep 2015 17:52:01 GMT
Server: Apache/2.2.15 (CentOS)
Location: https://cloud.cse.univdhaka.edu/cloud
Content-Length: 310
Connection: close
  
```

Content-Type: text/html; charset=iso-8859-1

```
<!DOCTYPE HTML PUBLIC "-//IETF//DTD HTML 2.0//EN">
<html><head>
<title>302 Found</title>
</head><body>
<h1>Found</h1>
<p>The document has moved <a href="https://cloud.cse.univdhaka.edu/cloud">here</a>.</p>
<hr>
<address>Apache/2.2.15 (CentOS) Server at cloud.cse.univdhaka.edu Port 80</address>
</body></html>
```

Connection closed by foreign host.

However, when you tried to view the same web site using a browser, you received a completely different web page. Give a possible reason for that. (4)

7. Suppose that your department has a local DNS server for all computers in the department. You are an ordinary user (i.e. no a network/system admin). Can you determine if an external Web site was likely accessed from a computer in your department a couple of seconds ago? Explain. (3)
8. In BitTorrent, a new peer Alice joins without possessing any chunk. Without any chunks, she cannot become a top-four uploaders for any of the other peers, since she has nothing to upload. How then will Alice get her first chunk? (2)

9. A system admin was trying to debug his FTP server installation. The screen capture of his

8. In BitTorrent, a new peer Alice joins without possessing any chunk. Without any chunks, she cannot become a top-four uploaders for any of the other peers, since she has nothing to upload. How then will Alice get her first chunk? (2)
9. A system admin was trying to debug his FTP server installation. The screen capture of his communication history with FTP server is given below. Comment on the actions he performed with the FTP server. (5)

```
xyz@xyz-700T1C:~$ telnet localhost 21
Trying 127.0.0.1...
Connected to localhost.
Escape character is '^]'.
220 700T1C FTP server ready.
user xyz
331 Password required for xyz.
pass 1234xxxx
230 User xyz logged in.
help
214- The following commands are recognized (* =>'s unimplemented).
  USER      QUIT    STOR    ABOR    SITE    XPWD    MLFL*    EPRT      CONF*
  PASS       PORT    STOU    DELE    SYST    XCUP    MAIL*    EPSV      ENC*
  ACCT*      PASV    APPE    RMD     STAT    XCWD    MSND*    LPRT      MIC*
  CWD        TYPE    ALLO    MKD     HELP    FEAT    MSOM*    LPSV      PBSZ*
  CDUP       STRU    REST    PWD     NOOP    OPTS    MSAM*    ADAT*     PROT*
  SMNT*      MODE    RNFR    LIST    XMKD    SIZE    MRSQ*    AUTH*
  REIN*      RETR    RNT0    NLST    XRMD    MDTM    MRCP*    CCC*
214 Direct comments to ftp-bugs@shabbir-700T1C.
LIST
425 Can't build data connection: Connection refused.
```