



UNIVERSITI  
TEKNOLOGI  
PETRONAS

## FINAL EXAMINATION MAY 2024 SEMESTER

**COURSE** : TEB1063/TFB1093 - DATA COMMUNICATION AND NETWORK

**DATE** : 9 AUGUST 2024 (FRIDAY)

**TIME** : 3:00 PM - 6:00 PM (3 HOURS)

### INSTRUCTIONS TO CANDIDATES

1. Answer **ALL** questions in the Answer Booklet.
2. Begin **EACH** answer on a new page in the Answer Booklet.
3. Indicate clearly answers that are cancelled, if any.
4. Where applicable, show clearly steps taken in arriving at the solutions and indicate **ALL** assumptions, if any.
5. **DO NOT** open this Question Booklet until instructed.

**Note** :

- i. There are **NINE (9)** pages in this Question Booklet including the cover page
- ii. **DOUBLE-SIDED** Question Booklet.

1. a. Explain the responsibility of each layer of the four-layer TCP/IP protocol suite.

[4 marks]

- b. The following are packets captured during a session of Internet browsing. Answer the following questions based on the capture and indicate the packet number where you identify the answer.

No.	Source	Destination	Protocol	Info
1	192.168.1.20	1.1.1.1	DNS	Standard query 0xa506 AAAA www.free-short-stories.org.uk
2	192.168.1.20	1.1.1.1	DNS	Standard query 0x20eb A www.free-short-stories.org.uk
3	192.168.1.20	1.1.1.1	DNS	Standard query 0x4670 HTTPS www.free-short-stories.org.uk
4	1.1.1.1	192.168.1.20	DNS	Standard query response 0xa506 AAAA www.free-short-stories.org.uk SOA ns3.freeola.net
5	1.1.1.1	192.168.1.20	DNS	Standard query response 0x20eb A www.free-short-stories.org.uk SOA ns3.freeola.net
6	1.1.1.1	192.168.1.20	DNS	Standard query response 0x4670 HTTPS www.free-short-stories.org.uk A 81.27.92.125
7	192.168.1.20	81.27.92.125	TCP	63870 → 443 [SYN] Seq=0 Win=64240 Len=0 MSS=1460 WS=256 SACK_PERM
8	81.27.92.125	192.168.1.20	TCP	443 → 63870 [SYN, ACK] Seq=0 Ack=1 Min=29200 Len=0 MSS=1452 SACK_PERM WS=128
9	192.168.1.20	81.27.92.125	TCP	63870 → 443 [ACK] Seq=1 Ack=1 Min=132096 Len=0
10	192.168.1.20	81.27.92.125	TLSv1.2	Client Hello (SNI=www.free-short-stories.org.uk)
11	81.27.92.125	192.168.1.20	TCP	443 → 63870 [ACK] Seq=1 Ack=550 Win=30336 Len=0
12	81.27.92.125	192.168.1.20	TLSv1.2	Server Hello, Certificate, Server Key Exchange, Server Hello Done
13	192.168.1.20	81.27.92.125	TLSv1.2	Alert (Level: Fatal, Description: Certificate Unknown)
14	192.168.1.20	81.27.92.125	TCP	63870 → 443 [FIN, ACK] Seq=557 Ack=1312 Win=130816 Len=0
15	81.27.92.125	192.168.1.20	TCP	443 → 63870 [FIN, ACK] Seq=1312 Ack=558 Win=30336 Len=0
16	192.168.1.20	81.27.92.125	TCP	63870 → 443 [ACK] Seq=558 Ack=1313 Win=130816 Len=0

FIGURE Q1: captured data packets

- i. Analyze the captured packets and identify all Client(s) and Server(s) IP Addresses. Explain your answer.

[2 marks]

- ii. Determine which transport layer protocol is used for the communication between the client(s) and the server(s). Support your answer with evidence from the packet data, citing packet numbers.

[2 marks]

- iii. Analyze the packet capture and describe the process of how the client establishes a connection with the server.

[2 marks]

- c. i. Write a complete python script for a server that can accept a few lines of input from a web browser and print the lines onto the server's standard output.

[6 marks]

- ii. Explain how you would test the client/server setup and the expected output in part (c)(i).

[4 marks]

2. a. Explain **TWO (2)** reasons why File Transport Protocol requires the use of Transport Control Protocol (TCP) instead of User Datagram Protocol (UDP).

[4 marks]

- b. **FIGURE Q2** depicts a communication between a File Transfer Protocol (FTP) client and server that has been captured for analysis.

No.	Source	Destination	Protocol	Info
1	203.135.15.2	203.135.15.14	TCP	2055 > 21 [SYN] Seq=0 win=8192 Len=0 MSS=1460
2	203.135.15.14	203.135.15.2	TCP	21 > 2055 [SYN, ACK] Seq=0 Ack=1 win=8192 Len=0 MSS=1460
3	203.135.15.2	203.135.15.14	TCP	2055 > 21 [ACK] Seq=1 Ack=1 win=8192 Len=0
4	203.135.15.14	203.135.15.2	FTP	Response: 220 FtpServerTry FtpD for free
5				<Ignored>
6				<Ignored>
7				<Ignored>
8				<Ignored>
9	203.135.15.2	203.135.15.14	FTP	[TCP ACKED lost segment] [TCP previous segment lost] Request: RETR /index.html
10	203.135.15.2	203.135.15.14	TCP	2057 > 2052 [SYN] Seq=0 win=8192 Len=0 MSS=1460
11	203.135.15.14	203.135.15.2	TCP	2052 > 2057 [SYN, ACK] Seq=0 Ack=1 win=8192 Len=0 MSS=1460
12	203.135.15.2	203.135.15.14	TCP	2057 > 2052 [ACK] Seq=1 Ack=1 win=8192 Len=0
13	203.135.15.14	203.135.15.2	FTP	Response: 150 Sending /index.html (468 bytes). Mode STREAM Type BINARY
14	203.135.15.14	203.135.15.2	TCP	2052 > 2057 [PSH, ACK] Seq=1 Ack=1 win=8192 Len=468
15	203.135.15.14	203.135.15.2	TCP	2052 > 2057 [FIN, ACK] Seq=469 Ack=1 win=8192 Len=0
16	203.135.15.2	203.135.15.14	TCP	2057 > 2052 [ACK] Seq=1 Ack=470 win=7723 Len=0
17	203.135.15.2	203.135.15.14	TCP	2057 > 2052 [FIN, ACK] Seq=1 Ack=470 win=7723 Len=0
18	203.135.15.14	203.135.15.2	TCP	2052 > 2057 [ACK] Seq=470 Ack=2 win=8191 Len=0
19	203.135.15.2	203.135.15.14	TCP	2055 > 21 [ACK] Seq=82 Ack=468 win=7725 Len=0
20	203.135.15.14	203.135.15.2	FTP	Response: 226 Transfer finished successfully. Data connection closed.
21	203.135.15.2	203.135.15.14	TCP	2055 > 21 [ACK] Seq=82 Ack=529 win=7664 Len=0
22	203.135.15.2	203.135.15.14	FTP	Request: QUIT
23	203.135.15.14	203.135.15.2	FTP	Response: 221 Goodbye.
24	203.135.15.2	203.135.15.14	TCP	2055 > 21 [ACK] Seq=88 Ack=543 win=7650 Len=0
25	203.135.15.2	203.135.15.14	TCP	2055 > 21 [FIN, ACK] Seq=88 Ack=543 win=7650 Len=0
26	203.135.15.14	203.135.15.2	TCP	21 > 2055 [ACK] Seq=543 Ack=89 win=8104 Len=0

FIGURE Q2: captured FTP data packets

- i. Determine the addresses of both the FTP client and the server. Explain your answer.

[4 marks]

- ii. Determine the number of ports that were opened in this communication. Explain your answer.

[2 marks]

- iii. Determine the number of channel(s) that was/were opened in this communication and explain its/their purpose(s).

[4 marks]

- iv. Explain the steps that were involved in the transfer of the file *index.html* from the beginning until the end of the conversation.

[6 marks]

3. a. A block of addresses is granted to a small organization. If one of the addresses is 205.16.37.39/28, evaluate the following,
- i. the first address in the block, [2 marks]
  - ii. the last address in the block, [2 marks]
  - iii. the number of addresses in the block. [2 marks]
- b. A startup company that wishes to have an Internet presence is granted a range of addresses from 203.135.190.0 to 203.135.191.255 by a local Internet Service Provider. It has eight departments and wishes to segregate their network based on these departments. Propose a network design for this company and explain your process in each step of the design. [8 marks]
- c. A corporate network is allocated with a block of address 205.16.37.32/28 has grown in number of users and attached devices over a course of five-year operation. The current users are estimated at 250 unique hosts. Propose a solution that will enable all users to be Internet ready. [6 marks]

4. The **FIGURE Q3** depicts a Domain Name System (DNS) query and reply using nslookup command.

```
C:\>nslookup
Default Server: matrix.utp.edu.my
Address: 160.0.226.202

> datacom.edu.my
Non-authoritative answer:
Server: matrix.utp.edu.my
Address: 160.0.226.202

Name: datacom.edu.my
Address: 60.51.71.42

> server ns1.dnsexit.com
Default Server: ns1.dnsexit.com
Address: 63.223.76.173

> datacom.edu.my
Server: ns1.dnsexit.com
Address: 63.223.76.173

Name: datacom.edu.my
Address: 60.51.71.42
```

**FIGURE Q3:** DNS query and reply

- a. Describe the meaning of Non-Authoritative Answer in the first reply.

[2 marks]

- b. Explain why the second query does not contain any Non-Authoritative reply.

[2 marks]

- c. You are asked to set up a web site for your company located in Cyberjaya, Selangor. Describe the process that you will go through considering that the company has just begun its operation and has never been connected to the Internet.

[8 marks]

- d. Describe the following terms about the DNS infrastructure:

i. zone

[2 marks]

ii. resolve

[2 marks]

iii. recursive resolution

[2 marks]

iv. iterative resolution

[2 marks]



5. a. i. Explain the problem in IPV4 that leads to the development of Network Address Translation (NAT).  
[2 marks]
- ii. Describe how NAT works.  
[6 marks]
- iii. Explain **TWO (2)** differences between public addresses and private addresses.  
[4 marks]
- b. Assume that in a Stop-and-Wait ARQ the bandwidth of the link is 1 Mbps and 1 bit takes 20 ms to make a round trip. Evaluate the following,
- i. bandwidth-delay product,  
[3 marks]
- ii. percentage of the utilization of the link if the system data frames are 1000 bits in length.  
[3 marks]
- c. State the technique used in Go-Back-N ARQ to improve the bandwidth utilization as compared to Stop-and-Wait ARQ.  
[2 marks]

-END OF PAPER-

