UNIVERSITI TUNKU ABDUL RAHMAN

ACADEMIC YEAR 2022/2023

SEPTEMBER EXAMINATION

UCCN1004 DATA COMMUNICATIONS AND NETWORKING

WEDNESDAY, 28 SEPTEMBER 2022 TIME : 2.00 PM – 4.00 PM (2 HOURS)

BACHELOR OF INFORMATION TECHNOLOGY (HONOURS)
COMMUNICATIONS AND NETWORKING
BACHELOR OF INFORMATION TECHNOLOGY (HONOURS)
COMPUTER ENGINEERING
BACHELOR OF INFORMATION SYSTEMS (HONOURS)
INFORMATION SYSTEMS ENGINEERING
BACHELOR OF INFORMATION SYSTEMS (HONOURS)
BUSINESS INFORMATION SYSTEMS
BACHELOR OF COMPUTER SCIENCE (HONOURS)
BACHELOR OF INFORMATION SYSTEMS (HONOURS)
DIGITAL ECONOMY TECHNOLOGY

Instruction to Candidates:

This question paper consists of THREE (3) questions in Section A and TWO (2) questions in Section B.

Answer **ALL** questions in **Section A** and **ONLY ONE (1)** question in **Section B**.

Should a candidate answer more than ONE (1) questions in section B, marks will only be awarded for the FIRST question in that section in the order the candidate submits the answers.

Candidates are allowed to use a scientific calculator.

Answer questions only in the answer booklet provided.

UCCN1004 DATA COMMUNICATIONS AND NETWORKING

Section A (Compulsory Questions)

Q1. Figure 1 shows the IP configurations of PC1.

```
Wireless LAN adapter Wi-Fi:

   Connection-specific DNS Suffix  . :
   Description . . . . . . . . . . . : Intel(R) Dual Band Wireless-AC 7265
   Physical Address. . . . . . . . . : E4-42-A6-B6-9B-03
   DHCP Enabled. . . . . . . . . . . : Yes
   Autoconfiguration Enabled . . . . : Yes
   Link-local IPv6 Address . . . . . : fe80::4dda:2811:c34d:4185%4(Preferred)
   IPv4 Address. . . . . . . . . . . : 192.168.68.119(Preferred)
   Subnet Mask . . . . . . . . . . . : 255.255.255.0
   Lease Obtained. . . . . . . . . . : 19 January, 2022 1:49:50 PM
   Lease Expires . . . . . . . . . . : 19 January, 2022 3:49:51 PM
   Default Gateway . . . . . . . . . : fe80::b295:75ff:fe31:44c0%4
                                       192.168.68.1
   DHCP Server . . . . . . . . . . . : 192.168.68.1
   DHCPv6 IAID . . . . . . . . . . . : 70579787
   DHCPv6 Client DUID. . . . . . . . : 00-01-00-01-27-6C-AB-D7-F4-4D-30-E3-AB-0D
   DNS Servers . . . . . . . . . . . : 192.168.0.1
                                       192.168.68.1
   NetBIOS over Tcpip. . . . . . . . : Enabled

Ethernet adapter Ethernet:

   Connection-specific DNS Suffix  . : utarict
   Description . . . . . . . . . . . : Realtek PCIe GBE Family Controller
   Physical Address. . . . . . . . . : F4-4D-30-E3-AB-0D
   DHCP Enabled. . . . . . . . . . . : Yes
   Autoconfiguration Enabled . . . . : Yes
   Link-local IPv6 Address . . . . . : fe80::20c3:166:9549:a61f%15(Preferred)
   IPv4 Address. . . . . . . . . . . : 192.168.238.87(Preferred)
   Subnet Mask . . . . . . . . . . . : 255.255.255.0
   Lease Obtained. . . . . . . . . . : 10 January, 2022 3:06:48 PM
   Lease Expires . . . . . . . . . . : 27 January, 2022 7:50:51 AM
   Default Gateway . . . . . . . . . : 192.168.238.254
                                       192.168.201.1
   DHCP Server . . . . . . . . . . . : 192.168.201.5
   DHCPv6 IAID . . . . . . . . . . . : 99896624
   DHCPv6 Client DUID. . . . . . . . : 00-01-00-01-27-6C-AB-D7-F4-4D-30-E3-AB-0D
   DNS Servers . . . . . . . . . . . : 192.168.201.1
                                       192.168.201.13
   NetBIOS over Tcpip. . . . . . . . : Enabled
```

Figure 1

(a) Based on network configurations in Figure 1, identify how many networks can PC1 join concurrently? Explain your answers. (2 marks)

(b) Determine the following addresses for the Wi-Fi Network:

(i) The broadcast address (2 marks)

(ii) The network address (2 marks)

(iii) The usable IP address range (2 marks)

Q1. (Continued)

(c) Suppose that a PC is physically 300 meters away from the router. Suggest **ONE (1)** device that can be used to minimize signal attenuation when connecting the PC to the router. (4 marks)

(d) Explain why does a PC always get the same private IP address assigned even after renewing the IP address lease? (4 marks)

(e) Determine the maximum theoretical transmission bandwidth for the Ethernet network if a CAT6a cable is used to connect this PC to the router? (2 marks)

(f) Visualize the DORA process in which the PC request a dynamic IP from a DHCP server in the Ethernet network. (7 marks)

[Total : 25 marks]

Q2. Figure 2 shows a Virtual Local Area Networks (VLANs) assignment in Switch S0.

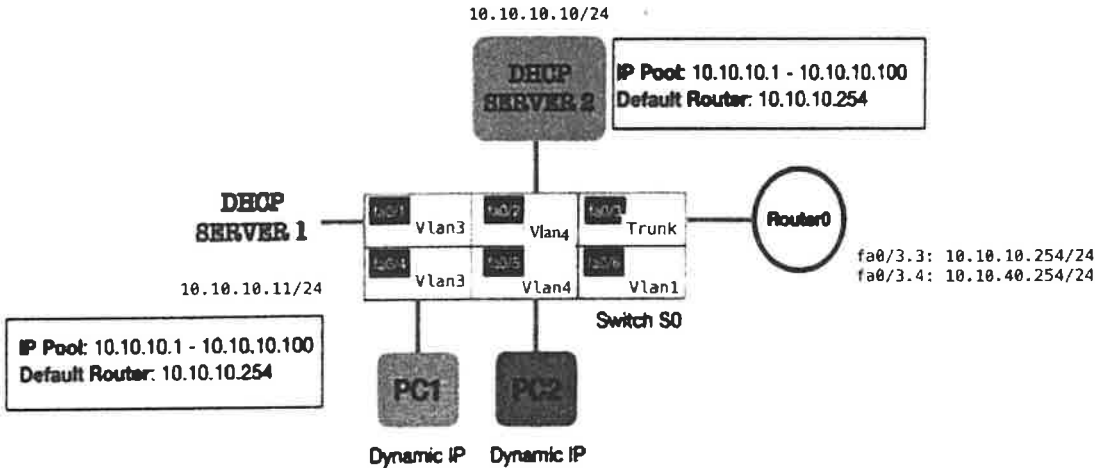

Figure 2

(a) Explain **TWO (2)** benefits of using VLANs compared to physical LANs. (6 marks)

Q2. (Continued)

(b) Determine if the following devices can ping each other based on the VLAN port membership in Switch S0.

(i) PC1 to PC2

(ii) PC1 to Router0

(iii) PC1 to DHCP Server2 (6 marks)

(c) Supposed that PC1 obtained a dynamic IP from DHCP Server1 and PC2 obtained a dynamic IP from DHCP Server2. The user reported that PC1's network status is showing connected to the network but no Internet. Discuss **ONE (1)** possible reason. (6 marks)

(d) State the DHCP command to configure the DHCP service on Router0 with the following criteria:

- Pool name: *swimmingpool*
- DNS server IP: 10.10.10.252
- Excluded IP address range: 10.10.10.1 – 10.10.10.100

(7 marks)
[Total : 25 marks]

Q3. Figure 3a shows a network topology of several networks.

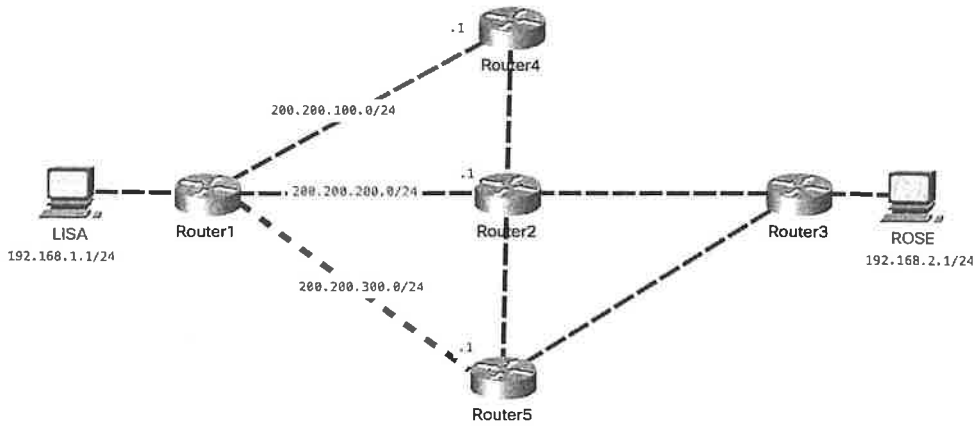

Figure 3a

(a) State the Cisco IOS command to configure **RIPv1** on Router1. (4 marks)

Q3. (Continued)

(b) Supposed that all routers are configured with RIPv1 and no alternate routings are configured. Suggest the path a packet will traverse when LISA sends a data packet to ROSE. Explain your answers. (6 marks)

(c) Supposed that the network admin configured a few additional routes in Router1. Based on the routing table of Router1 in Figure 3b, suggest the path a packet will traverse when LISA pings ROSE. Explain your answers. (5 marks)

```
C    192.168.1.0 is directly connected
C    200.200.100.0 is directly connected
C    200.200.200.0 is directly connected
C    200.200.300.0 is directly connected
S    192.168.2.0/24 [1/0] via 200.200.100.1
R    192.168.2.0/24 [120/3] via 200.200.100.1
R    192.168.2.0/24 [120/3] via 200.200.200.1
R    192.168.2.0/24 [120/3] via 200.200.300.1
```

Figure 3b

(d) LISA attempts to ping to 10.10.10.10 but LISA received an ICMP reply that indicates the ping is not successful. Determine which was the device that sends this ICMP error message to LISA. (4 marks)

(e) Configure Router1 to sends data packet to Router4 as the last resort gateway. (6 marks)

[Total : 25 marks]

Section B (Choose Any One Question)

Q4. Figure 4 shows a TCP segment dump captured using Wireshark. There are no options used in this TCP header. Answer the following questions based on the packet payload.

```
09 6d 00 15 70 e3 5e 4a 84 f4
3e aa 50 18  ff  af 17  6a 00 00
50 41 53 53 20 63 69 73 63 6f
0d 0a
```

Figure 4

(a) Determine the types of layer-5 service for this segment based on the TCP header. (4 marks)

(b) Determine if this packet is sent from client-to-server or from a server-to-client? Explain your answers. (4 marks)

(c) What are the options used in this TCP segment? Explain your answers. (4 marks)

(d) Which TCP flags are set to 1 in this TCP segment? (4 marks)

(e) Assume that there is a password contained in this TCP segment. The data bytes for the password is **61 76 6f 63 61 72 72 79**. Decode the password into ASCII format. (4 marks)

(f) Distinguish active FTP mode vs passive FTP mode using a diagram. (5 marks)

[Total : 25 marks]

Q5. (a) Figure 5a shows the topology of a home network. Based on Figure 5a, determine the following (assume all cables are CAT6a):

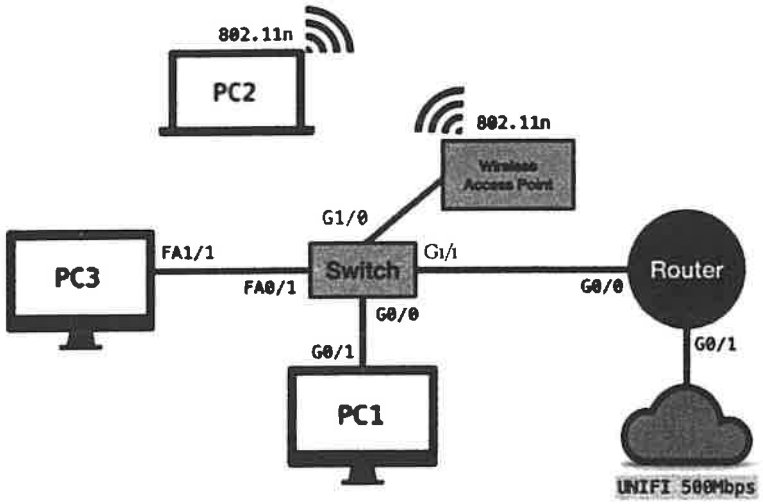

Figure 5a

(i) The maximum effective Internet bandwidth for PC1. (3 marks)

(ii) The maximum effective bandwidth from PC1 to PC2. (3 marks)

(iii) The maximum effective Internet bandwidth for PC3. (3 marks)

(iv) The maximum effective Internet bandwidth for PC2. (3 marks)

(b) Explain using an example how is bandwidth different from throughput in measuring network performance. (5 marks)

(c) Figure 5b below shows a network topology with DNS and Web servers. Avo browses to banana.com using Google Chrome. Draw the flow of DNS queries if the target domain name records are not cached in the recursive DNS. (3 marks)

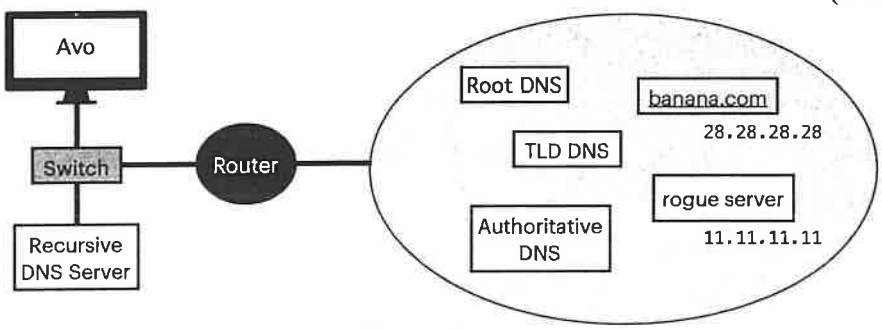

Figure 5b

Q5. (Continued)

(d) Figure 5c shows the DNS cache records for the recursive DNS after DNS resolution. Draw the flow of DNS cache poisoning attack on the recursive DNS server to redirect users to the rogue web server using the network in Figure 5b. (5 marks)

URL	IP
banana.com	28.28.28.28
google.com	216.58.221.206
apple.com	17.253.144.10

Figure 5c

[Total : 25 marks]

UCCN1004 DATA COMMUNICATIONS AND NETWORKING

Appendix

Appendix I. ASCII table

Dec	Hx	Oct	Char	Dec	Hx	Oct	Html	Chr	Dec	Hx	Oct	Html	Chr	Dec	Hx	Oct	Html	Chr
0	0	000	NUL (null)	32	20	040		Space	64	40	100	@	@	96	60	140	`	`
1	1	001	SOH (start of heading)	33	21	041	!	!	65	41	101	A	A	97	61	141	a	a
2	2	002	STX (start of text)	34	22	042	"	"	66	42	102	B	B	98	62	142	b	b
3	3	003	ETX (end of text)	35	23	043	#	#	67	43	103	C	C	99	63	143	c	c
4	4	004	EOT (end of transmission)	36	24	044	$	$	68	44	104	D	D	100	64	144	d	d
5	5	005	ENQ (enquiry)	37	25	045	%	%	69	45	105	E	E	101	65	145	e	e
6	6	006	ACK (acknowledge)	38	26	046	&	&	70	46	106	F	F	102	66	146	f	f
7	7	007	BEL (bell)	39	27	047	'	'	71	47	107	G	G	103	67	147	g	g
8	8	010	BS (backspace)	40	28	050	(	(	72	48	110	H	H	104	68	150	h	h
9	9	011	TAB (horizontal tab)	41	29	051	)	)	73	49	111	I	I	105	69	151	i	i
10	A	012	LF (NL line feed, new line)	42	2A	052	*	*	74	4A	112	J	J	106	6A	152	j	j
11	B	013	VT (vertical tab)	43	2B	053	+	+	75	4B	113	K	K	107	6B	153	k	k
12	C	014	FF (NP form feed, new page)	44	2C	054	,	,	76	4C	114	L	L	108	6C	154	l	l
13	D	015	CR (carriage return)	45	2D	055	-	-	77	4D	115	M	M	109	6D	155	m	m
14	E	016	SO (shift out)	46	2E	056	.	.	78	4E	116	N	N	110	6E	156	n	n
15	F	017	SI (shift in)	47	2F	057	/	/	79	4F	117	O	O	111	6F	157	o	o
16	10	020	DLE (data link escape)	48	30	060	0	0	80	50	120	P	P	112	70	160	p	p
17	11	021	DC1 (device control 1)	49	31	061	1	1	81	51	121	Q	Q	113	71	161	q	q
18	12	022	DC2 (device control 2)	50	32	062	2	2	82	52	122	R	R	114	72	162	r	r
19	13	023	DC3 (device control 3)	51	33	063	3	3	83	53	123	S	S	115	73	163	s	s
20	14	024	DC4 (device control 4)	52	34	064	4	4	84	54	124	T	T	116	74	164	t	t
21	15	025	NAK (negative acknowledge)	53	35	065	5	5	85	55	125	U	U	117	75	165	u	u
22	16	026	SYN (synchronous idle)	54	36	066	6	6	86	56	126	V	V	118	76	166	v	v
23	17	027	ETB (end of trans. block)	55	37	067	7	7	87	57	127	W	W	119	77	167	w	w
24	18	030	CAN (cancel)	56	38	070	8	8	88	58	130	X	X	120	78	170	x	x
25	19	031	EM (end of medium)	57	39	071	9	9	89	59	131	Y	Y	121	79	171	y	y
26	1A	032	SUB (substitute)	58	3A	072	:	:	90	5A	132	Z	Z	122	7A	172	z	z
27	1B	033	ESC (escape)	59	3B	073	;	;	91	5B	133	[	[	123	7B	173	{	{
28	1C	034	FS (file separator)	60	3C	074	<	<	92	5C	134	\	\	124	7C	174			|
29	1D	035	GS (group separator)	61	3D	075	=	=	93	5D	135	]	]	125	7D	175	}	}
30	1E	036	RS (record separator)	62	3E	076	>	>	94	5E	136	^	^	126	7E	176	~	~
31	1F	037	US (unit separator)	63	3F	077	?	?	95	5F	137	_	_	127	7F	177	&#127;	DEL

Source: www.LookupTables.com

Appendix II. TCP Header