CMP-405 – Spring 2019 Midterm Exam Name:_____

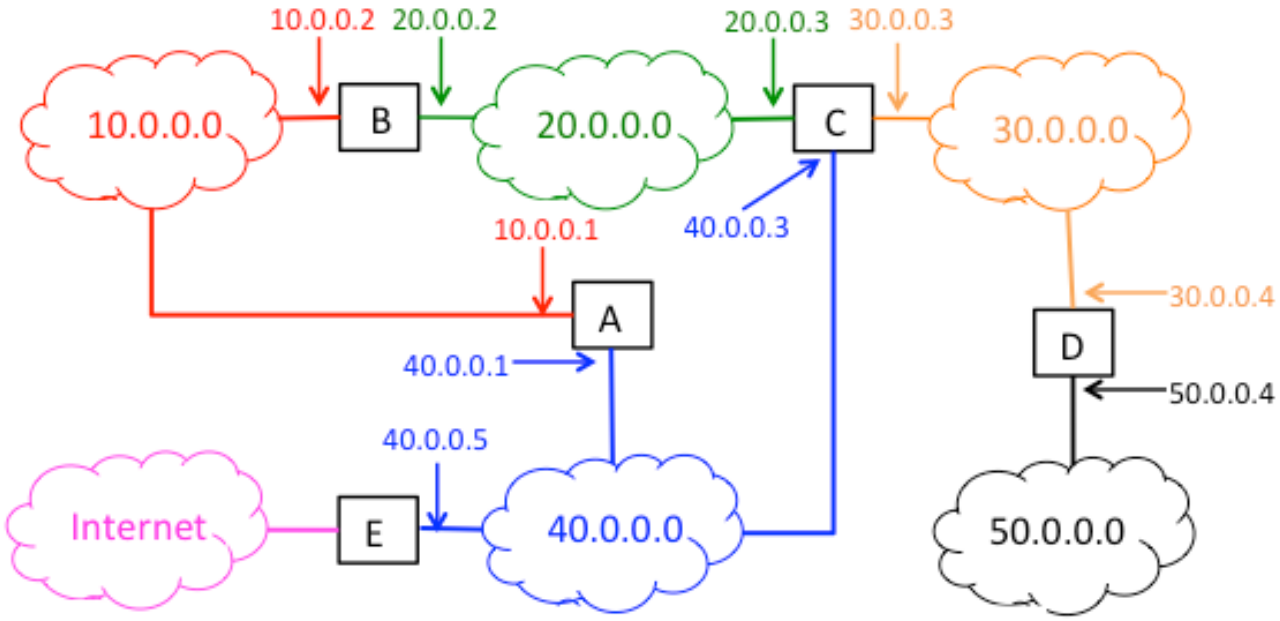
Total of 110 Points

Version 1

Instructions

- **Answer Question 1 on the exam paper.**
- **Answer Questions 2-5 on the yellow paper.**
- **One question per page, use only one side of the yellow paper.**
- **Write your name on the exam paper.**
- **Write your name and version number on the top of the yellow paper.**

1. (24 Points) Show the most efficient routing tables for routers A, B, C, and D. Make sure you account for traffic to the Internet. Use the shortest possible route. Router E should only be used for Internet traffic.



	Router A	Router B	Router C	Router D
Network	Next Hop	Next Hop	Next Hop	Next Hop
10.0.0.0				
20.0.0.0				
30.0.0.0				
40.0.0.0				
50.0.0.0				
Default				

CMP-405 – Spring 2019 Midterm Exam Name:_____

Total of 110 Points

Version 1

2. (26 Points) Explain fragmentation as it relates to datagrams. Why is it necessary? How does IP keep track of the fragments? Where does it occur? When and where are the fragments reassembled? **Give examples and be as specific as possible**.

3. (20 Points) Given the class A network address 109.0.0.0 will be divided into multiple subnets.
   a. (5 Points) How many bits will be necessary to address 8,000 subnets?
   b. (5 Points) What is the maximum number of hosts on each subnet?
   c. (5 Points) What is the subnet mask?
   d. (5 Points) Write the dotted decimal IP address of subnet 7,861 - host 1,953

4. (15 Points) Given the IP address 169.213.209.233 and the subnet mask of 255.255.248.0.
   a. (5 Points) What is the network number?
   b. (5 Points) What is the subnet number?
   c. (5 Points) What is the host number?

5. (25 Points) A frame is formatted as follows:

Destination Hardware Address	Source Hardware Address	Frame Type	Frame Data
6 Bytes	6 Bytes	2 Bytes	46 - 1500 Bytes

An IP datagram is formatted as follows:

Byte	0								1								2								3							
bit	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
0	Version				Header Length				Type Of Service								Total Length															
4	Identification																Flags				Fragment Offset											
8	TTL								Type								Header Checksum															
12	Source IP Address																															
16	Destination IP Address																															
Optional	IP Options (May Be Omitted)																								Padding							
20	IP Payload Data																															

A UDP datagram is formatted as follows:

Byte	0								1								2								3							
bit	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
0	Source Port																Destination Port															
4	UDP Message Length																UDP Checksum															
8	UDP Payload Data																															

Assuming no options are present in the IP header, answer the following questions for the given frame. (See next page for the frame and questions).

CMP-405 – Spring 2019 Midterm Exam Name:_____

Total of 110 Points

Version 1

Given the following frame with an encapsulated UDP datagram:

1D	9E	12	26	6A	39	56	16	A9	5D	6C	15	08	00	45	2B
00	72	86	20	54	24	19	30	E2	96	90	48	BF	9A	6B	AD
B8	72	BB	99	14	8C	E6	BE	F5	AF	C2	20	DE	5F	D7	29
6F	97	D9	3D	85	D2	61	4F	81	45	06	FC	C6	E7	94	36
19	7B	20	6C	1E	FF	D6	B3	19	47	FA	83	20	F1	A6	F4
18	01	CE	AA	D1	CC	3F	22	71	C0	E8	FF	8B	EC	DE	58
B3	7C	72	65	67	4C	09	93	35	B3	4A	17	A2	53	01	5D
94	34	A5	EA	C6	C5	DF	C3	E1	20	70	FE	03	2D	7C	47

a. Find the destination hardware address.
b. Find the source hardware address.
c. What type of frame is this?
d. What is the IP total length?
e. What is the Identification?
f. What Flag(s) are set in the IP header?
g. What is the fragment offset?
h. What is the TTL count?
i. What is the IP Header Checksum?
j. Find the source IP address.
k. What class is the source IP address?
l. What is the network ID in the source IP address?
m. What is the host ID in the source IP address?
n. Write the source IP address in dotted decimal notation.
o. Find the destination IP address.
p. What class is the destination IP address?
q. What is the network ID in the destination IP address?
r. What is the host ID in the destination IP address?
s. Write the destination IP address in dotted decimal notation.
t. Can this message be delivered directly by the source to the destination, or will it require routers to handle the message. Explain..
u. Find the UDP source port.
v. Find the UDP destination port.
w. Find the UDP checksum.
x. Find the UDP Message Length
y. If the IP header includes no options or padding, what are the first five bytes of the UDP datagram data?

CMP-405 – Spring 2019 Midterm Exam Name:_____

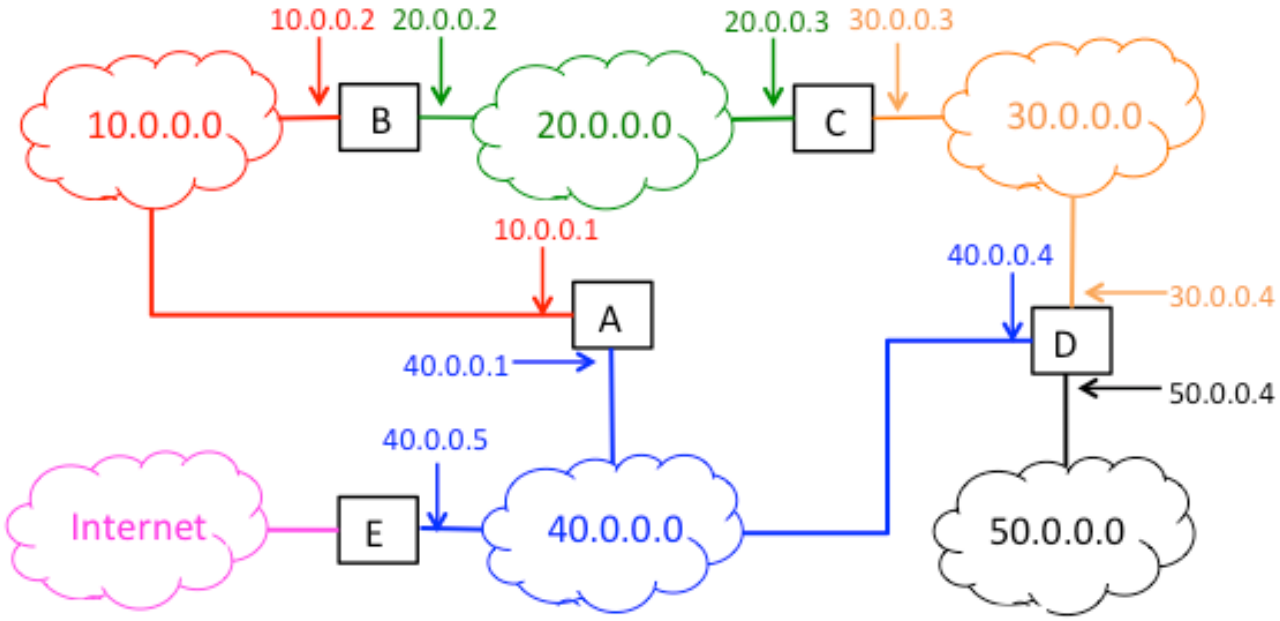
Total of 110 Points

Version 2

Instructions

- **Answer Question 1 on the exam paper.**
- **Answer Questions 2-5 on the yellow paper.**
- **One question per page, use only one side of the yellow paper.**
- **Write your name on the exam paper.**
- **Write your name and version number on the top of the yellow paper.**

1. (24 Points) Show the most efficient routing tables for routers A, B, C, and D. Make sure you account for traffic to the Internet. Use the shortest possible route. Router E should only be used for Internet traffic.



	Router A	Router B	Router C	Router D
Network	Next Hop	Next Hop	Next Hop	Next Hop
10.0.0.0				
20.0.0.0				
30.0.0.0				
40.0.0.0				
50.0.0.0				
Default				

CMP-405 – Spring 2019 Midterm Exam Name:_____

Total of 110 Points

Version 2

2. (26 Points) Explain fragmentation as it relates to datagrams. Why is it necessary? How does IP keep track of the fragments? Where does it occur? When and where are the fragments reassembled? **Give examples and be as specific as possible**.

3. (20 Points) Given the class A network address 119.0.0.0 will be divided into multiple subnets.
   a. (5 Points) How many bits will be necessary to address 8,050 subnets?
   b. (5 Points) What is the maximum number of hosts on each subnet?
   c. (5 Points) What is the subnet mask?
   d. (5 Points) Write the dotted decimal IP address of subnet 7,845 - host 1,949.

4. (15 Points) Given the IP address 188.225.227.237 and the subnet mask of 255.255.248.0.
   a. (5 Points) What is the network number?
   b. (5 Points) What is the subnet number?
   c. (5 Points) What is the host number?

5. (25 Points) Given that a frame is formatted as follows:

Destination Hardware Address	Source Hardware Address	Frame Type	Frame Data
6 Bytes	6 Bytes	2 Bytes	46 - 1500 Bytes

An IP datagram is formatted as follows:

Byte	0				1				2				3			
bit	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
0	Version				Header Length				Type Of Service								Total Length															
4	Identification																Flags				Fragment Offset											
8	TTL								Type								Header Checksum															
12	Source IP Address																															
16	Destination IP Address																															
Optional	IP Options (May Be Omitted)																								Padding							
20	IP Payload Data																															

A UDP datagram is formatted as follows:

Byte	0								1								2								3							
bit	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
0	Source Port																Destination Port															
4	UDP Message Length																UDP Checksum															
8	UDP Payload Data																															

Assuming no options are present in the IP header, answer the following questions for the given frame. (See next page for the frame and questions).

CMP-405 – Spring 2019 Midterm Exam Name:_____

Total of 110 Points

Version 2

Given the following frame with an encapsulated UDP datagram:

54	AD	C0	38	C8	33	A9	23	18	87	71	28	08	00	45	0D
00	72	6B	2A	22	07	02	BB	2E	1E	CE	76	CC	99	73	8A
85	93	D3	19	DD	0E	16	D1	62	93	5E	57	D5	7E	62	EB
18	EE	62	C1	F7	2F	66	C3	A4	E1	F9	68	B4	81	C8	F9
AA	55	FF	7A	09	AF	4F	9A	09	11	A5	2C	43	10	38	5D
59	F5	74	9F	FA	FD	61	90	D0	CF	27	CA	B4	29	6E	C3
28	05	47	95	91	78	4F	85	B9	EC	A8	63	B0	A5	E0	2A
5D	D2	E9	FE	D0	FC	4F	2B	CE	5C	0F	19	B4	EE	65	CD

a. Find the destination hardware address.
b. Find the source hardware address.
c. What type of frame is this?
d. What is the IP total length?
e. What is the Identification?
f. What Flag(s) are set in the IP header?
g. What is the fragment offset?
h. What is the TTL count?
i. What is the IP Header Checksum?
j. Find the source IP address.
k. What class is the source IP address?
l. What is the network ID in the source IP address?
m. What is the host ID in the source IP address?
n. Write the source IP address in dotted decimal notation.
o. Find the destination IP address.
p. What class is the destination IP address?
q. What is the network ID in the destination IP address?
r. What is the host ID in the destination IP address?
s. Write the destination IP address in dotted decimal notation.
t. Can this message be delivered directly by the source to the destination, or will it require routers to handle the message. Explain..
u. Find the UDP source port.
v. Find the UDP destination port.
w. Find the UDP checksum.
x. Find the UDP Message Length
y. If the IP header includes no options or padding, what are the first five bytes of the UDP datagram data?

CMP-405 – Spring 2019 Midterm Exam Name:_____

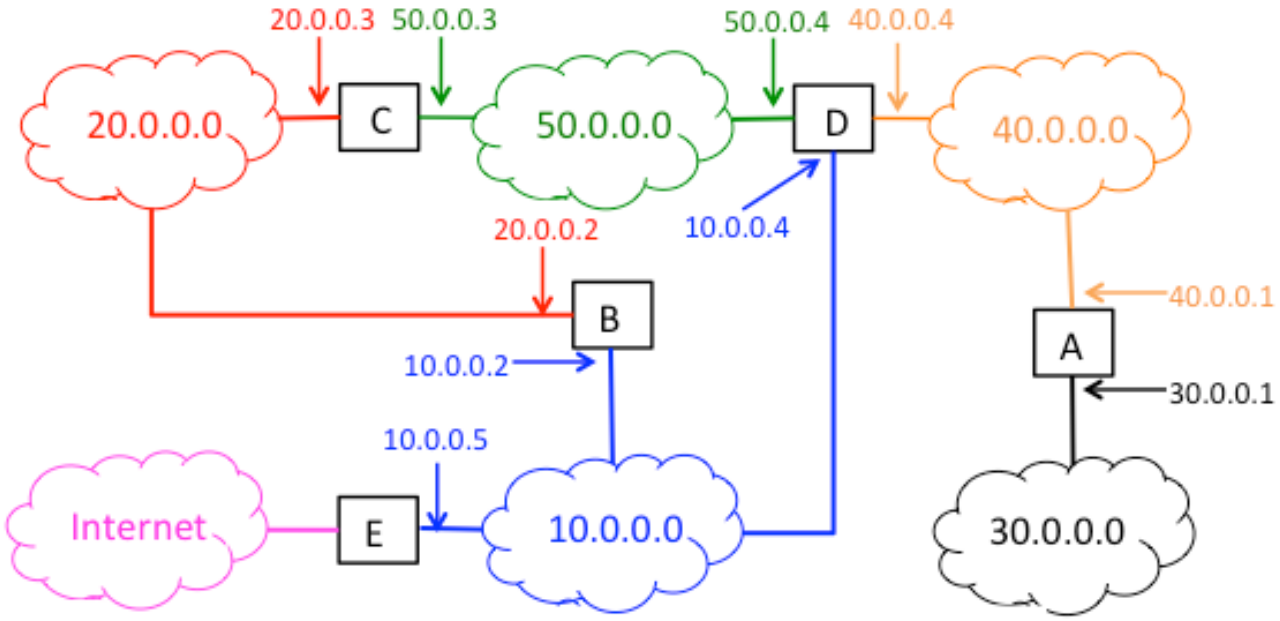
Total of 110 Points

Version 3

Instructions

- **Answer Question 1 on the exam paper.**
- **Answer Questions 2-5 on the yellow paper.**
- **One question per page, use only one side of the yellow paper.**
- **Write your name on the exam paper.**
- **Write your name and version number on the top of the yellow paper.**

1. (24 Points) Show the most efficient routing tables for routers A, B, C, and D. Make sure you account for traffic to the Internet. Use the shortest possible route. Router E should only be used for Internet traffic.



	Router A	Router B	Router C	Router D
Network	Next Hop	Next Hop	Next Hop	Next Hop
10.0.0.0				
20.0.0.0				
30.0.0.0				
40.0.0.0				
50.0.0.0				
Default				

CMP-405 – Spring 2019 Midterm Exam Name:_____

Total of 110 Points

Version 3

2. (26 Points) Explain fragmentation as it relates to datagrams. Why is it necessary? How does IP keep track of the fragments? Where does it occur? When and where are the fragments reassembled? **Give examples and be as specific as possible**.

3. (20 Points) Given the class A network address 115.0.0.0 will be divided into multiple subnets.
   a. (5 Points) How many bits will be necessary to address 8,100 subnets?
   b. (5 Points) What is the maximum number of hosts on each subnet?
   c. (5 Points) What is the subnet mask?
   d. (5 Points) Write the dotted decimal IP address of subnet 7,941 - host 1,982.

4. (15 Points) Given the IP address 186.229.219.211 and the subnet mask of 255.255.248.0.
   a. (5 Points) What is the network number?
   b. (5 Points) What is the subnet number?
   c. (5 Points) What is the host number?

5. (25 Points) Given that a frame is formatted as follows:

Destination Hardware Address	Source Hardware Address	Frame Type	Frame Data
6 Bytes	6 Bytes	2 Bytes	46 - 1500 Bytes

An IP datagram is formatted as follows:

Byte	0				1				2				3			
bit	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
0	Version				Header Length				Type Of Service								Total Length															
4	Identification																Flags				Fragment Offset											
8	TTL								Type								Header Checksum															
12	Source IP Address																															
16	Destination IP Address																															
Optional	IP Options (May Be Omitted)																								Padding							
20	IP Payload Data																															

A UDP datagram is formatted as follows:

Byte	0								1								2								3							
bit	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
0	Source Port																Destination Port															
4	UDP Message Length																UDP Checksum															
8	UDP Payload Data																															

Assuming no options are present in the IP header, answer the following questions for the given frame. (See next page for the frame and questions).

CMP-405 – Spring 2019 Midterm Exam Name:_____

Total of 110 Points

Version 3

Given the following frame with an encapsulated UDP datagram:

0B	97	19	E3	E4	AB	DE	F9	2D	34	5E	D5	08	00	45	F2
00	72	78	54	4F	E5	B5	77	CB	75	D2	69	5D	A6	76	9E
D2	70	5F	80	F6	31	B2	8D	D2	EB	20	2E	26	1F	5D	5E
E3	A4	E8	BB	45	9E	7E	B9	14	7E	0D	5A	2D	4C	E6	F7
94	B6	AC	7C	65	38	41	72	8B	AE	F0	83	54	D1	49	81
A4	C5	98	A7	16	2E	C2	ED	28	B7	6B	0A	98	C7	36	33
35	EA	52	A3	DD	A1	28	1A	57	A5	29	8E	1B	24	E2	CC
C5	3D	FE	87	FE	1D	D8	B3	D1	A1	C5	52	2E	70	7B	F6

a. Find the destination hardware address.
b. Find the source hardware address.
c. What type of frame is this?
d. What is the IP total length?
e. What is the Identification?
f. What Flag(s) are set in the IP header?
g. What is the fragment offset?
h. What is the TTL count?
i. What is the IP Header Checksum?
j. Find the source IP address.
k. What class is the source IP address?
l. What is the network ID in the source IP address?
m. What is the host ID in the source IP address?
n. Write the source IP address in dotted decimal notation.
o. Find the destination IP address.
p. What class is the destination IP address?
q. What is the network ID in the destination IP address?
r. What is the host ID in the destination IP address?
s. Write the destination IP address in dotted decimal notation.
t. Can this message be delivered directly by the source to the destination, or will it require routers to handle the message. Explain..
u. Find the UDP source port.
v. Find the UDP destination port.
w. Find the UDP checksum.
x. Find the UDP Message Length
y. If the IP header includes no options or padding, what are the first five bytes of the UDP datagram data?

CMP-405 – Spring 2019 Midterm Exam Name:_____

Total of 110 Points

Version 4

Instructions

- **Answer Question 1 on the exam paper.**
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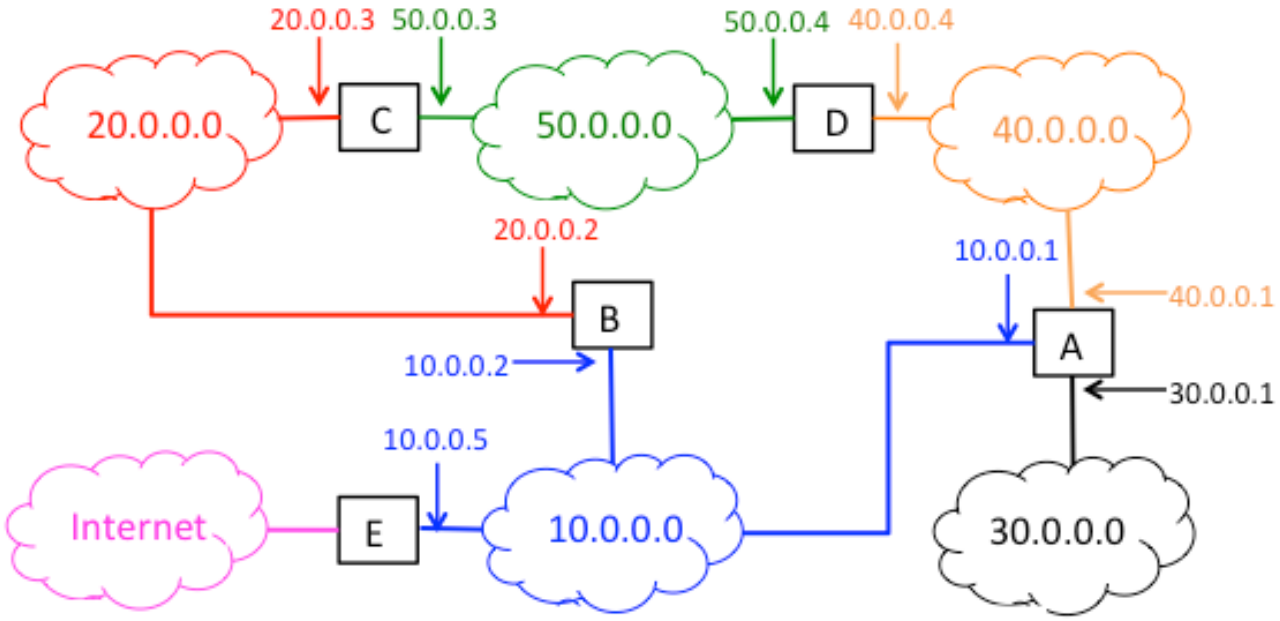
- **One question per page, use only one side of the yellow paper.**
- **Write your name on the exam paper.**
- **Write your name and version number on the top of the yellow paper.**

1. (24 Points) Show the most efficient routing tables for routers A, B, C, and D. Make sure you account for traffic to the Internet. Use the shortest possible route. Router E should only be used for Internet traffic.



	Router A	Router B	Router C	Router D
Network	Next Hop	Next Hop	Next Hop	Next Hop
10.0.0.0				
20.0.0.0				
30.0.0.0				
40.0.0.0				
50.0.0.0				
Default				

CMP-405 – Spring 2019 Midterm Exam Name:_____

Total of 110 Points

Version 4

2. (26 Points) Explain fragmentation as it relates to datagrams. Why is it necessary? How does IP keep track of the fragments? Where does it occur? When and where are the fragments reassembled? **Give examples and be as specific as possible**.

3. (20 Points) Given the class A network address 121.0.0.0 will be divided into multiple subnets.
   a. (5 Points) How many bits will be necessary to address 8,025 subnets?
   b. (5 Points) What is the maximum number of hosts on each subnet?
   c. (5 Points) What is the subnet mask?
   d. (5 Points) Write the dotted decimal IP address of subnet 7,911- host 1,988.

4. (15 Points) Given the IP address 175.241.231.222 and the subnet mask of 255.255.248.0.
   a. (5 Points) What is the network number?
   b. (5 Points) What is the subnet number?
   c. (5 Points) What is the host number?

5. (25 Points) Given that a frame is formatted as follows:

Destination Hardware Address	Source Hardware Address	Frame Type	Frame Data
6 Bytes	6 Bytes	2 Bytes	46 - 1500 Bytes

An IP datagram is formatted as follows:

Byte	0				1				2				3			
bit	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
0	Version				Header Length				Type Of Service								Total Length															
4	Identification																Flags				Fragment Offset											
8	TTL								Type								Header Checksum															
12	Source IP Address																															
16	Destination IP Address																															
Optional	IP Options (May Be Omitted)																								Padding							
20	IP Payload Data																															

A UDP datagram is formatted as follows:

Byte	0								1								2								3							
bit	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
0	Source Port																Destination Port															
4	UDP Message Length																UDP Checksum															
8	UDP Payload Data																															

Assuming no options are present in the IP header, answer the following questions for the given frame. (See next page for the frame and questions).

CMP-405 – Spring 2019 Midterm Exam Name:_____

Total of 110 Points

Version 4

Given the following frame with an encapsulated UDP datagram:

5D	A1	D6	61	C1	AD	8C	7E	B5	8D	CB	BA	08	00	45	38
00	72	D7	EF	30	B5	30	D6	36	35	57	AB	1D	97	C6	2F
78	ED	F4	21	89	A0	C6	58	B6	BE	8C	B5	F0	26	75	B7
68	F0	58	F4	EB	97	C0	53	F7	1F	F6	16	1A	A9	FB	C9
6C	30	26	0D	02	D8	20	70	D1	2B	E2	9E	EA	A0	AC	6A
43	50	DA	01	26	88	47	B2	64	FC	0D	EA	5A	C1	8F	BF
35	A4	AD	BF	2D	8E	52	BB	38	F2	64	28	A0	0E	A5	BC
2F	A9	AB	EA	CC	F5	01	61	E1	DF	4D	6D	A3	73	51	47

a. Find the destination hardware address.
b. Find the source hardware address.
c. What type of frame is this?
d. What is the IP total length?
e. What is the Identification?
f. What Flag(s) are set in the IP header?
g. What is the fragment offset?
h. What is the TTL count?
i. What is the IP Header Checksum?
j. Find the source IP address.
k. What class is the source IP address?
l. What is the network ID in the source IP address?
m. What is the host ID in the source IP address?
n. Write the source IP address in dotted decimal notation.
o. Find the destination IP address.
p. What class is the destination IP address?
q. What is the network ID in the destination IP address?
r. What is the host ID in the destination IP address?
s. Write the destination IP address in dotted decimal notation.
t. Can this message be delivered directly by the source to the destination, or will it require routers to handle the message. Explain..
u. Find the UDP source port.
v. Find the UDP destination port.
w. Find the UDP checksum.
x. Find the UDP Message Length
y. If the IP header includes no options or padding, what are the first five bytes of the UDP datagram data?