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Homework 4

Problem 1:

A 244-byte MTU leaves 224 bytes for data after the 20-byte IP header.

M-bit (more fragments to follow)	Offset	# of Data Bytes	Location of Fragmentation
1	0	224	1st fragment
1	28	224	1st fragment
1	56	64	1st fragment
1	64	224	2nd fragment
1	92	224	2nd fragment
1	120	64	2nd fragment
1	128	224	3rd fragment
0	156	152	3rd fragment

Start of header				
Ident = x			1	Offset = 0
Rest of header				
224 data bytes				

Start of header				
Ident = x			1	Offset = 28
Rest of header				
224 data bytes				

Start of header				
Ident = x			1	Offset = 56
Rest of header				
64 data bytes				

Start of header				
Ident = x			1	Offset = 64
Rest of header				
224 data bytes				

Start of header				
Ident = x			1	Offset = 92
Rest of header				
224 data bytes				

Start of header				
Ident = x			1	Offset = 120
Rest of header				
64 data bytes				

Start of header				
Ident = x			1	Offset = 128
Rest of header				
224 data bytes				

Start of header				
Ident = x			0	Offset = 156
Rest of header				
152 data bytes				

$$\text{\# of fragments} = \frac{1400}{224} = \mathbf{7\ fragments}$$

If packets were originally fragmented for this MTU, there would be seven (7) fragments. The first 6 fragments would have 224 bytes each. The last fragment would have 56 bytes.

Problem 2:

(a) 128.13.155.144

BITWISE AND	~~**255.255.255.128**~~	**255.255.255.192**
128.13.155.144	~~**128.13.155.128**~~	**128.13.155.128**

Next Hop: R3

When the subnet mask 255.255.255.192 is applied, we receive 128.13.155.128, so router R3 is used as the next hop.

(b) 128.13.155.62

BITWISE AND	~~**255.255.255.128**~~	~~**255.255.255.192**~~
128.13.155.62	~~**128.13.155.0**~~	~~**128.13.155.0**~~

Next Hop: R4

When the subnet masks 255.255.255.192 and 255.255.255.192 are applied, we receive 128.13.155.0 as the subnet number, so the default router R4 is used as the next hop since there is no match.

(c) 128.64.72.69

BITWISE AND	**255.255.255.128**	~~**255.255.255.192**~~
128.64.72.69	**128.64.72.0**	~~**128.64.72.64**~~

Next Hop: R2

When the subnet mask 255.255.255.128 is applied, we receive 128.64.72.0, so router R2 is used as the next hop.

(d) 128.65.73.25

BITWISE AND	**255.255.255.128**	~~**255.255.255.192**~~
128.65.73.25	**128.65.73.0**	~~**128.65.73.0**~~

Next Hop: Interface 0

When the subnet mask 255.255.255.128 is applied, we receive 128.65.73.0, so router Interface 0 is used as the next hop.

(e) 192.64.73.176

BITWISE AND	~~**255.255.255.128**~~	**255.255.255.192**
192.64.73.176	~~**192.64.73.128**~~	**192.64.73.128**

Next Hop: Interface 1

When the subnet mask 255.255.255.192 is applied, we receive 192.64.73.128, so router Interface 1 is used as the next hop.

Problem 3:

(a) Each node knows only the distances to its immediate neighbors

Information Stored at Node	Distance to Reach Node					
	A	***B***	***C***	***D***	***E***	***F***
A	0	3	∞	∞	∞	∞
B	3	0	3	4	∞	∞
C	∞	3	0	∞	3	∞
D	∞	4	∞	0	1	∞
E	∞	∞	3	1	0	1
F	∞	∞	∞	∞	1	0

(b) Each node has reported the information it had in the preceding step to its immediate neighbors

Information Stored at Node	Distance to Reach Node					
	A	***B***	***C***	***D***	***E***	***F***
A	0	3	6	7	∞	∞
B	3	0	3	4	5	∞
C	6	3	0	4	3	4
D	7	4	4	0	1	2
E	∞	5	3	1	0	1
F	∞	∞	4	2	1	0

(c) Step (b) happens a second time

Information Stored at Node	Distance to Reach Node					
	A	***B***	***C***	***D***	***E***	***F***
A	0	3	6	7	8	∞
B	3	0	3	4	5	6
C	6	3	0	4	3	4
D	7	4	4	0	1	2
E	8	5	3	1	0	1
F	∞	6	4	2	1	0

Problem 4:

Routing table for node A:

STEP	CONFIRMED	TENTATIVE
1	(A,0,-)	
2	(A,0,-)	(B,6,B) (C,2,C)
3	(A,0,-) (C,2,C)	(B,5,C) (D,6,C) (E,8,C)
4	(A,0,-) (C,2,C) (B,5,C)	(D,6,C) (E,7,C)
5	(A,0,-) (C,2,C) (B,5,C) (D,6,C)	(E,7,C) (F,8,C)
6	(A,0,-) (C,2,C) (B,5,C) (D,6,C) (E,7,C)	(F,8,C)
7	(A,0,-) (C,2,C) (B,5,C) (D,6,C) (E,7,C) (F,8,C)	