In the name of God

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CE 443: Computer Networks

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Homework 3
Solutions

1. Suppose we want to transmit a message 1110010 and use CRC polynomial $x^3 + 1$ to protect it against errors.

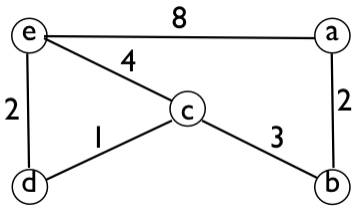
   - What is the message that should be transmitted?
   - Suppose the 2nd bit (from left) is inverted due to noise. What is the resulting CRC calculation on the receiver side? How does he know that an error has occured?

   Solutions:

   101 should be added to the end of the message.

   If there is an error in the 2nd bit, then the remainder will be 100.

2. Given the following network:



   Fill out the routing table seen by each of the nodes using the Distance Vector algorithm. (use the table formatting in slide 8 of lecture 13). How many iteration of the DV algorithm is required before the routing tables stabilize?

   Solutions[1]**:**

Step 1															
Table for A			Table for B			Table for C			Table for D			Table for E			
Dst	Cst	Hop	Dst	Cst	Hop	Dst	Cst	Hop	Dst	Cst	Hop	Dst	Cst	Hop	
A	0	A	A	2	A	A	∞	-	A	∞	-	A	8	A	
B	2	B	B	0	B	B	3	B	B	∞	-	B	∞	-	
C	∞	-	C	3	C	C	0	C	C	1	C	C	4	C	
D	∞	-	D	∞	-	D	1	D	D	0	D	D	2	D	
E	8	E	E	∞	-	E	4	E	E	2	E	E	0	E	

[1]Solutions are taken from the HW submission by H. Eslami

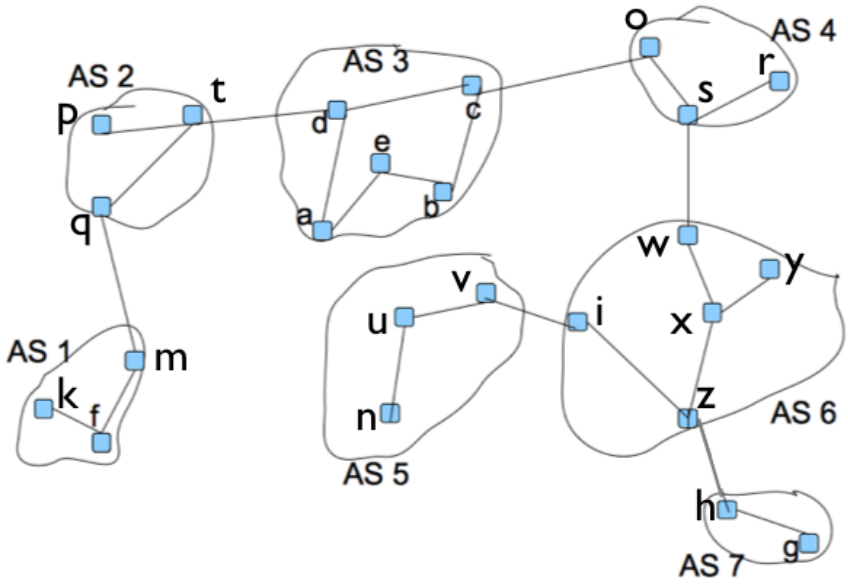
Step 2															
Table for A			Table for B			Table for C			Table for D			Table for E			
Dst	Cst	Hop	Dst	Cst	Hop	Dst	Cst	Hop	Dst	Cst	Hop	Dst	Cst	Hop	
A	0	A	A	2	A	A	5	B	A	10	E	A	8	A	
B	2	B	B	0	B	B	3	B	B	4	C	B	7	C	
C	5	B	C	3	C	C	0	C	C	1	C	C	3	D	
D	10	E	D	4	C	D	1	D	D	0	D	D	2	D	
E	8	E	E	7	C	E	3	D	E	2	E	E	0	E	

Step 3															
Table for A			Table for B			Table for C			Table for D			Table for E			
Dst	Cst	Hop	Dst	Cst	Hop	Dst	Cst	Hop	Dst	Cst	Hop	Dst	Cst	Hop	
A	0	A	A	2	A	A	5	B	A	6	C	A	8	A	
B	2	B	B	0	B	B	3	B	B	4	C	B	6	D	
C	5	B	C	3	C	C	0	C	C	1	C	C	3	D	
D	6	B	D	4	C	D	1	D	D	0	D	D	2	D	
E	8	E	E	6	C	E	3	D	E	2	E	E	0	E	

Step 4															
Table for A			Table for B			Table for C			Table for D			Table for E			
Dst	Cst	Hop	Dst	Cst	Hop	Dst	Cst	Hop	Dst	Cst	Hop	Dst	Cst	Hop	
A	0	A	A	2	A	A	5	B	A	6	C	A	8	E	
B	2	B	B	0	B	B	3	B	B	4	C	B	6	D	
C	5	B	C	3	C	C	0	C	C	1	C	C	3	D	
D	6	B	D	4	C	D	1	D	D	0	D	D	2	D	
E	8	E	E	6	C	E	3	D	E	2	E	E	0	E	

Step 3 and 4 looks the same, so in this case the algorithm converges in 3 iterations.

3. Given the network below:



Assume the following, AS1 owns prefix 1.1.0.0/16, AS2 owns 2.1.0.0/16, AS3 owns no specific prefix, AS4 owns 4.1.0.0/16, AS5 owns 3.1.1/24, AS6 owns 6.1.0.0/16 and AS7 owns 7.1.0.0/16. Each AS has routers running BGP and advertises the prefixes it owns, and also the routes it hears. Also, assume equal link cost between all routers.

- What routing protocols are executed by each of the routers a, b, c, d, and e?
  Solutions: a,b,e are running IGP and iBGP, c and d are running IGP, iBGP, eBGP
- What advertisements do routers in AS2 see?
  Solutions:
  1.1.0.0/16 —- AS1
  4.1.0.0/16 —- AS3 AS4
  3.1.1.0/24 —- AS3 AS4 AS6 AS5
  6.1.0.0/16 —- AS3 AS4 AS6
  7.1.0.0/16 —- AS3 AS4 AS6 AS7

- What advertisements do routers AS5 see?
  Solutions:
  1.1.0.0/16 —- AS6 AS4 AS3 AS2 AS1
  2.1.0.0/16 —- AS6 AS4 AS3 AS2
  4.1.0.0/16 —- AS6 AS4
  6.1.0.0/16 —- AS6
  7.1.1.0/16 —- AS6 AS7

- Write down the BGP table for router c, i, and t.
  Solutions:
  i:

Prefix	BGP Next Hop
1.1.0.0/16	s
2.1.0.0/16	s
4.1.0.0/16	s
3.1.1.0/24	v
7.1.0.0/16	h

t:

Prefix	BGP Next Hop
1.1.0.0/16	m
4.1.0.0/16	d
3.1.1.0/24	d
6.1.0.0/16	d
7.1.0.0/16	d

c:

Prefix	BGP Next Hop
1.1.0.0/16	t
2.1.0.0/16	t
4.1.0.0/16	o
3.1.1.0/24	o
6.1.0.0/16	o
7.1.0.0/16	o