CSC358 Tutorial 8

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Question 1: Concept Review

(a) We learned that a BGP message contains the AS-PATH and NEXT-HOP attributes. Which attribute is useful when a router updates its forwarding table?

(b) Discuss how BGP prevents a routing loop between ASes such as AS1 $\rightarrow$ AS2 $\rightarrow$ AS3 $\rightarrow$ AS1.

(c) If all link-layer protocols in the Internet were to provide reliable delivery service, would the RDT protocol in TCP be redundant? Why or why not?

For the answers, review the lectures, books, go to office hours, and use the discussion board!

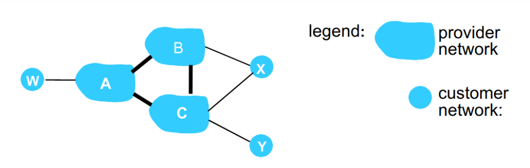
Consider the network on Page 23 of Week 9 lecture slides illustrating the effect of policies in BGP advertisement. Let's call w, x, y the customer networks, and call A, B, C the provider networks. Assume the following policies are chosen be B and x.

> Provider B chooses never to advertise the any path from A to C, or any path from C to A, to avoid traffic getting "free rides" over them (such as $w \to A \to B \to C \to y$).
>
> Customer network x, when routing from/to A, always chooses to go via provider B instead of provider C because of a commercial agreement with B.

What are the network topologies from w, x and y's point of view, i.e., the topologies based on the path information that is available at each of the customers? Draw the pictures

Question 2: BGP

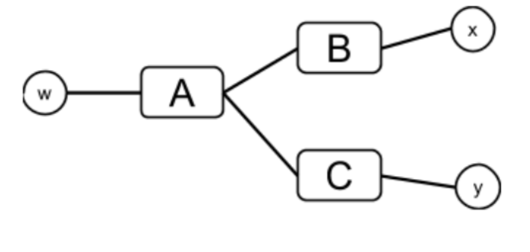
Just as a reminder, following is the network presented on Week 9 lecture slides:



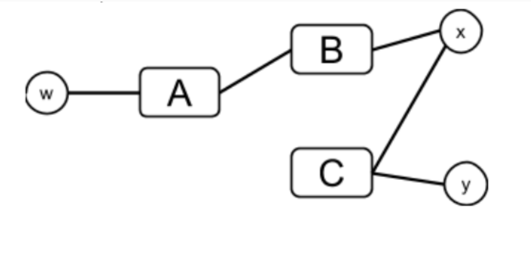
Provider B chooses never to advertise the any path from A to C, or any path from C to A, to avoid traffic getting "free rides" over them (such as $w \rightarrow A \rightarrow B \rightarrow C \rightarrow y$).

Customer network x, when routing from/to A, always chooses to go via provider B instead of provider C because of a commercial agreement with B.

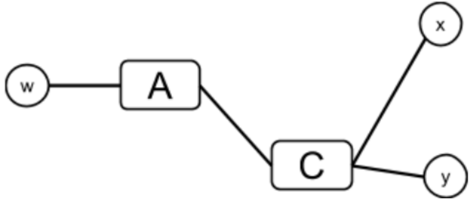
Topology from w's point of view:



Topology from x’s point of view:



Topology from y's point of view:



Question 3: CRC

(a) Using Cyclic Redundancy Check, given generator $G = 10011$ and data $D = 1010101010$, what is the value of R? Note for the long division procedure: the subtractions are XOR's instead.

(b) Find another D' which leads to the same R value as above. How do you find D' and what does having the same R mean in terms of error detection?

(c) To practice more, repeat the above calculations for the following data:

   (i) $D = 1001010101$
   (ii) $D = 0101101010$
   (iii) $D = 1010100000$

Use the following online calculator to verify your answer and practice even more!

http://www.ee.unb.ca/cgi-bin/tervo/calc.pl

Firstly, let's add four zeros to *D* to accommodate for the fact that *G* is 5-bit.

Next, we can divide G into D:

```
          1011011100
      ______________
10011)10101010100000
      10011
      -----
        1100
        0000
        ----
        11001
        10011
        -----
         10100
         10011
         -----
           1111
           0000
           ----
           11110
           10011
           -----
            11010
            10011
            -----
             10010
             10011
             -----
                0100
```

Hence we get remainder of $R = 0100$!

Find another D' which leads to the same R value as above.

Remember, we define $R \equiv D \cdot 2^r \mod G$
So if we add another multiple of G to D, R will remain the same:

$$\begin{aligned} D' &= D \oplus G \\ R &\equiv D' \cdot 2^r \mod G \\ &\equiv (D \oplus G) \cdot 2^r \mod G \\ &\equiv D \cdot 2^r \oplus \cancel{G \cdot 2^r} \mod G \\ &\equiv D \cdot 2^r \mod G \end{aligned}$$

So if we make a $D' \cdot 2^r$ = 10101 01010 0000 $\oplus$ 10011 0000 = 10101 11001 0000, do long division again and confirm that you get the same R value.

What does this mean in terms of error detection?

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So if we make a $D' \cdot 2^r$ = 10101 01010 0000 $\oplus$ 10011 0000 = 10101 11001 0000, do long division again and confirm that you get the same R value.

What does this mean in terms of error detection?

There's a possibility of false positives- the error detection isn't perfect. But the probability of this happening is low.

Question 3: CRC (c)

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(i) $R = 0000$

(ii) $R = 1111$

(iii) $R = 1001$