C-432 Solutions to HW 1A

~~Problem P55~~

The first 4 bits of the multicast IP address are 1110. The remaining 28 bits are free. So the size of the multicast address space is 2^{28}

The probability of 2 multicast addresses being the same is $1/2^{28}$. (This is similar to the probability of two dice coming up with the same number which is 1/6.) which is 0.000000004 approx

Let $n=2^{28}$. The first multicast address can be any one of n. If the second one is different from the first one, it can be any one of the remaining (n-1). Extending this argument if there are 1000 multicast addresses there are n(n-1)(n-2)……..(n-999) ways in which they can all be different . The total no of ways in which 1000 multicast addresses can be chosen at random without any conditions is n^{1000}. Hence the probability that they are all different is:

$$p(n) = \frac{n(n-1)(n-2).....(n-999)}{n.n.n.....n} = 1.(1-\frac{1}{n}).(1-\frac{2}{n}).....(1-\frac{999}{n})$$

Since n is large this can be approximated as

$$1-(\frac{1}{n}+\frac{2}{n}+.....+\frac{999}{n})$$

The probability of two or more multicast addresses being the same is 1-p(n) which is

$$\frac{1}{n}+\frac{2}{n}+.....+\frac{999}{n}=\frac{999.1000}{2.2^{28}}=0.002 approx$$

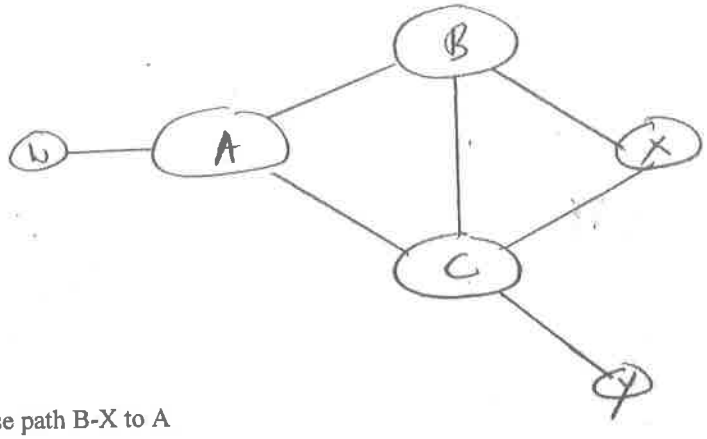
Problem P37

a. 3c learns from 4c using eBGP (they are in different domains AS3 and AS4)
b. 3a learns from 3c using iBGP (they are in the same domain AS3)
c. 1c learns from 3a using eBGP(they are in different domains AS1 and AS3)
d. 1d learns from 1c using iBGP (they are in the same domain AS1)

Problem P38

a. Since 1d learns from 1c $I=I_1$ (since this is the interface on which 1d learnt the prefix from 1c)
b. $I=I_2$ 1d learns the prefix x from both 1d and 1b. The no of domain hops AS1-AS3-AS4 is the same as the no of domain hops in AS1-AS2-AS4; however since there are fewer router hops in the path 1d-1b-2a-2c-4a-x as compared to 1d-1a-1c-3a-3b-3c-4c-4b-4a-x and interface I2 is preferred to reach x.
c. In this case $I=I_1$ (since there are fewer AS hops in the path AS1-AS3-AS4 as compared to AS1-AS2-AS5-AS4)

Problem P40



View from W

B will advertise path B-X to A

C will advertise paths C-X and C-Y to A

Based on these advertisements, A will advertise A-B-X and A-C-X to W A will also advertise path A-C-Y to W

Based on all the advertisements received by it , W will set up the following paths

W-A-B-X and W-A-C-X to X

W-A-C-Y to Y

In addition, if there are peering arrangements between B and C, B may additionally advertise B-X to C and C may additionally advertise C-Y to B

Based on these, B may advertise B-C-Y to A and C may advertise C-B-X to A

Then A may advertise paths A-B-C-X , A-C-B-X and A-B-C-Y to W

Based on these additional advertisements W may set up the following additional paths:

W-A-B-C-X and W-A-C-B-X to X and W-A-B-C-Y to Y

Note: Even in this case, the path W-A-B-X-C-Y will never be known to W. X being multihomed will neither advertise X-C to B nor advertise X-B to C

View from X (*Note: All advertisements and paths shown in red are subject to peering arrangements between A,B,C*)

Step 1:

A will advertise A-W to B and C

C will advertise C-Y to A,B and X

X does not advertise anything since it is multihomed and wishes to block any transit traffic

Step 2:

X will set up path X-C-Y to Y (primary path)

A will form path A-C-Y to Y and advertise it to B

B will form path B-A-W to W and advertise it to X and C

B will form path B-C-Y to Y and advertise it to A and X

C will form path C-A-W to W and advertise it to X and B

Step 3:

X will set up paths X-B-A-W and X-C-A-W to W (primary paths)

X will form path X-B-C-Y to Y (secondary path)

B will form path B-C-A-W to W and advertise it to X

B will form path B-A-C-Y to Y and advertise it to X

C will form path C-B-A-W to W and advertise it to X

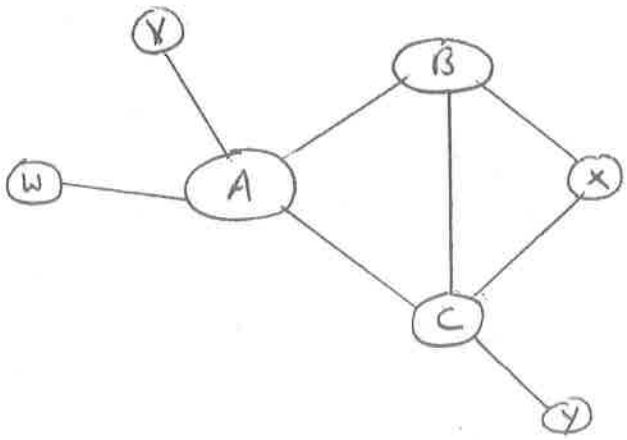
Step 4:

X will form path X-B-A-C-Y to Y (tertiary path)

X will form paths X-B-C-A-W and X-C-B-A-W to W (secondary paths)

Note: the longest path W-A-B-X-C-Y will never be formed since X prevents transit traffic by not advertising X-C to B

Problem P42



A should advertise A-W only to B
A should advertise A-V to both B and C
C gets the following routes:
To V: C-A-V and C-B-A-V
To W: C-B-A-W

Q21

(i) 2000::004D:ABCD
(ii) 2000::7328:0000:0000:8728
(iii) 2819:00AF::237C

Q22

Compare with 9 typess of valid IP-v6 addresses to find out if it belongs to any one of them. If not, it must be invalid

1. :: 128 zeroes – newly booted host
2. ::1 127 zeroes followed by 1 – loopback address
3. :: d.d.d.d 96 zeroes followed by 32 bit dotted decimal IP-v4 address – IP-v4 compatible address
4. ::FFFF:d.d.d.d 80 zeroes followed by 16 I's and then 32 bit dotted decimal IP-v4 address – IP-v4 mapped address
5. 11111111 ..... Address beginning with 8 1's – multicast address
6. 128 1's - Broadcast address
7. 001 ..... Address beginning with 001 – Aggregatable Global Unicast Address
8. FEC0:0000:0000 ..... Site local address
9. FE80:0000:0000:0000 ..... Link local address

(i) Begins with 001 - Aggregatable Global Unicast Address
(ii) Invalid (Does not match 3 or 4)
(iii) Invalid – 2 sets of ::
(iv) Begins with 8 1's - Multicast address
(v) Expands to FEC0:0000:0000:8706:342C:0009:0000:45EE - Site local address