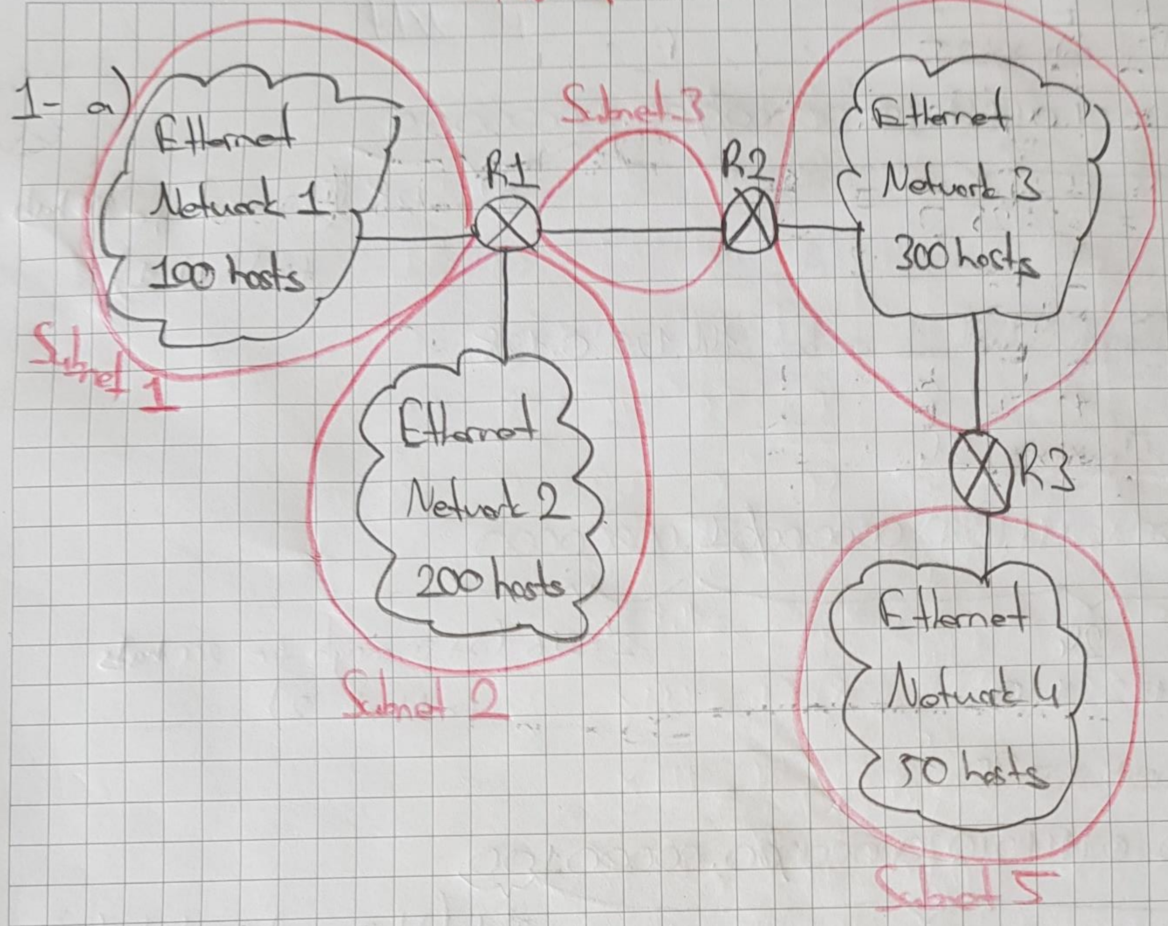
HW 4

1- a)



b) $\underbrace{10010000.01111010.000000}_{\text{Single prefix for } 144.122.0.0/22}\underbrace{00.00000000}_{\text{We can change this part}}$

x: minimum # of bits for host part
32-x: Distinguishing part
-2: 0.0.0.0
1.1.1.1 (broadcast)

Subnet 1: 100 hosts + 1 router $\quad 2^{32-x} - 2 \geq 101$

$2^{32-x} \geq 103 \quad$ min $x = 25$

Subnet 2: 200 hosts + 1 router $\quad 2^{32-x} - 2 \geq 201$

$2^{32-x} \geq 203 \quad$ min $x = 24$

Subnet 3: 0 hosts + 2 routers $\quad 2^{32-x} - 2 \geq 2$

$2^{32-x} \geq 4 \quad$ min $x = 30$

Subnet 4: 300 hosts + 2 routers $\quad 2^{32-x} - 2 \geq 302$

$2^{32-x} \geq 304 \quad$ min $x = 23$

Subnet 5: 50 hosts + 1 router $\quad 2^{32-x} - 2 \geq 51$

$2^{32-x} \geq 53 \quad$ min $x = 26$

Subnet 1: min x=25

10010000.01111010.000000/00.10000000

25

$2^7=128$ (It is enough for hosts for Subnet 1)

Network address of Subnet 1 can be 144.122.0.128 /25

Subnet 2: min x=24

10010000.01111010.000000/01.00000000

24

$2^8=256$ (It is enough for hosts for Subnet 2)

Address: 144.122.1.0 /24

Subnet 3: min x=30

10010000.01111010.000000/00.00000100

30

$2^2=4$ (It is enough for hosts for subnet 3)

Address: 144.122.0.4 /30

Subnet 4: min x=23

10010000.01111010.000000/10.00000000

23

$2^9=512$ (It is enough for hosts for Subnet 4)

Address: 144.122.2.0 /23

Subnet 5: min x=26

10010000.01111010.000000/00.01000000

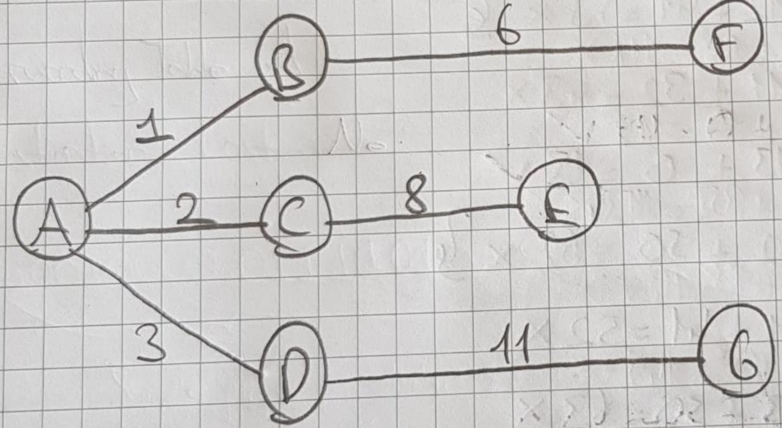
26

$2^6=64$ (It is enough for hosts)

Address: 144.122.0.64 /26

2-a)

Step	N'	D(B),p(B)	D(C),p(C)	D(D),p(D)	D(E),p(E)	D(F),p(F)	D(G),p(G)
0	A	1,A	2,A	3,A	∞	∞	∞
1	A,B	—	2,A	3,A	∞	7,B	∞
2	A,B,C	—	—	3,A	10,C	7,B	∞
3	A,B,C,D	—	—	—	10,C	7,B	14,D
4	A,B,C,D,F	—	—	—	10,C	—	14,D
5	A,B,C,D,F,E	—	—	—	—	—	14,D
6	A,B,C,D,F,E,G	—	—	—	—	—	—



b)

Forwarding Table in A:

Destination	Cost	Next Hop
B	1	B
C	2	C
D	3	D
E	10	C
F	7	B
G	14	D

3-a) Distance Table in X

From/To	X	A	B	C	D	E	F
X	0	11	13	12	61	31	51
A	∞	0	32	41	90	50	80
B	∞	32	0	50	70	18	62
C	∞	41	50	0	49	65	39

$D_X(A) = \min\{ c(X,A) + D_A(A) = 11 + 0 = 11$ ✓
$c(X,B) + D_B(A) = 13 + 32 = 45$ ✗
$c(X,C) + D_C(A) = 12 + 41 = 53$ ✗ $\}$

$D_X(B) = \min\{ c(X,A) + D_A(B) = 11 + 32 = 43$ ✗
$c(X,B) + D_B(B) = 13 + 0 = 13$ ✓
$c(X,C) + D_C(B) = 12 + 50 = 62$ ✗ $\}$

$D_X(C) = \min\{ c(X,A) + D_A(C) = 11 + 41 = 52$ ✗
$c(X,B) + D_B(C) = 13 + 50 = 63$ ✗
$c(X,C) + D_C(C) = 12 + 0 = 12$ ✓ $\}$

$D_X(D) = \min\{ c(X,A) + D_A(D) = 11 + 90 = 101$ ✗
$c(X,B) + D_B(D) = 13 + 70 = 83$ ✗
$c(X,C) + D_C(D) = 12 + 49 = 61$ ✓ $\}$

$D_X(E) = \min\{ c(X,A) + D_A(E) = 11 + 50 = 61$ ✗
$c(X,B) + D_B(E) = 13 + 18 = 31$ ✓
$c(X,C) + D_C(E) = 12 + 65 = 77$ ✗ $\}$

$D_X(F) = \min\{ c(X,A) + D_A(F) = 11 + 80 = 91$ ✗
$c(X,B) + D_B(F) = 13 + 62 = 75$ ✗
$c(X,C) + D_C(F) = 12 + 39 = 51$ ✓ $\}$

Distance vector of X:

	X	A	B	C	D	E	F
X	0	11	13	12	61	31	51

b) Distance vector sent to A:

	X	A	B	C	D	E	F
X	0	11	13	12	61	31	51

B:

	X	A	B	C	D	E	F
X	0	11	13	12	61	31	51

C:

	X	A	B	C	D	E	F
X	0	11	13	12	61	31	51

Distance Table in A F/T	X	A	B	C	D	E	F
X	0	11	13	12	61	31	51
A	11	0	24	23	72	42	62

Distance Table in B F/T	X	A	B	C	D	E	F
X	0	11	13	12	61	31	51
B	13	24	0	25	70	18	62

Distance Table in C F/T	X	A	B	C	D	E	F
X	0	11	13	12	61	31	51
C	12	23	25	0	49	43	39

Updates on A, B, C after receiving X distance vector.

c) i. Poisoned reverse used:

F/T	X	A	B	C	D	E	F
X	0	11	13	12	61	31	51
A	∞	0	32	41	90	50	80
B	∞	32	0	50	70	18	62
C	∞	41	50	0	49	65	39

Distance vector sent to A:

	X	A	B	C	D	E	F
X	0	∞	13	12	61	31	51

B:

	X	A	B	C	D	E	F
X	0	11	∞	12	61	∞	51

C:

	X	A	B	C	D	E	F
X	0	11	13	∞	∞	31	∞

Distance Table in A

F/T	X	A	B	C	D	E	F
X	0	∞	13	12	61	31	51
A	11	0	24	23	72	42	62

Distance Table in B

F/T	X	A	B	C	D	E	F
X	0	11	∞	12	61	∞	51
B	13	24	0	25	70	18	62

Distance Table in C

F/T	X	A	B	C	D	E	F
X	0	11	13	∞	∞	31	∞
C	12	23	25	0	49	43	39

Updates on the A, B, C after receiving X distance vector

ii. Thanks to the following example, we can justify answer. We can test that whether distance A to B change or not after distance received from X. We know distance A to X $(c(A,X))$, $D_X^{(B)}$ and distance A to D, E, F $(c(A,D), c(A,E), c(A,F))$. On the other hand, we do not know $D_D^{(B)}$, $D_E^{(B)}$ and $D_F^{(B)}$. To determine $D_A^{(B)}$, we do not need to know $D_D^{(B)}$, $D_E^{(B)}$ and $D_F^{(B)}$ because their distance to A $(c(A,D),$ $c(A,E), c(A,F))$ is greater than $c(A,X) + D_X^{(B)}$. That means $D_A^{(B)} = c(A,X) + D_X^{(B)} = 11+13 = 24$. Previous distance A to B is 32 changes to 24. Thus, A's distance vector changes.

$$D_A^{(B)} = \min \begin{cases} c(A,X) + D_X^{(B)} = 11+13 = 24 \\ c(A,D) + D_D^{(B)} = 30+? > 24 \text{ for sure} \\ c(A,E) + D_E^{(B)} = 50+? > 24 \quad \text{"} \quad \text{"} \\ c(A,F) + D_F^{(B)} = 80+? > 24 \quad \text{"} \quad \text{"} \end{cases}$$

We do not know D, E, F are neighbors of A but it is possibility. In all cases, $D_A^{(B)} = c(A,X) + D_X^{(B)}$ $= 24$