Solution to Assignment 5

Problem 1

1.a) Option 4: Packing data according to a specific protocol. Several protocols can be used such as WIFI

1.b) Option 1 : Parity Checks, Checksumming Methods, Cyclic Redundancy Methods

1 c) Option 2 : 2^{48} MAC addresses; 2^{32} IPv4 addresses; 2^{128} IPv6 addresses.

1.d) Option 1: - 2^{24} Adapters since MAC address space written with 48 bit, and the first 24 are fixed $2^{(48-24)} = 2^{24}$

1.e) Option 2:2 sub space – only the Router (the circle) divide the address space, switches are invisible.

Problem 2

Option 1
2.a (The leftmost column and bottom row are for parity bits.)

0 **1 0 1 0**
1 **0 1 1 1**
0 **0 1 0 1**
1 1 0 0 0

This is the only option were the sum of 1's in each of columns and rows are an even number.

Problem 3

Option 2: *R = 110*

Problem 4

4.a) Option 1: *1/N*

4.b) Option : $\frac{1}{e}$

Problem 5

5.a) Option 2:

$(1 - p(a))^3 \times p(A)$ where $p(A) =$ probability that A succeeds in a slot.

$$p(A) = p(A\ transmits\ and\ B\ does\ not\ and\ C\ does\ not\ and\ D\ does\ not)$$
$$= p(A\ transmits) \times p(B\ does\ not) \times p(C\ does\ not) \times p(D\ does\ not)$$
$$= p(1-p) \times (1-p) \times (1-p) = p(1-p)^3$$

Hence,

$$p(A\ succeeds\ for\ first\ time\ in\ slot\ 4) = (1 - p(A))^3 \times p(A)$$
$$= (1 - p(1-p)^3)^3 \times p(1-p)^3$$

5.b) Option 4:

$$p(A\ succeeds\ in\ slot\ 2) = p(1-p)^3$$
$$p(B\ succeeds\ in\ slot\ 2) = p(1-p)^3$$
$$p(C\ succeeds\ in\ slot\ 2) = p(1-p)^3$$
$$p(D\ succeeds\ in\ slot\ 2) = p(1-p)^3$$
$$p(either\ A\ or\ B\ or\ C\ or\ D\ succeeds\ in\ slot\ 2) = 4p(1-p)^3$$

(because these events are mutually exclusive)

5.c) Option 4:

$$p(some\ node\ succeeds\ in\ a\ slot) = 4p(1-p)^3$$

$p(no\ node\ succeeds\ in\ a\ slot) = 1 - 4p(1-p)^3$

Hence, $p * first\ success\ occurs\ in\ slot\ 4) = p(no\ node\ succeeds\ in\ firs\ 3\ slots) \times p(somenode\ succeeds\ in\ 4th\ slot) = (1 - 4p(1-p)^3)^3 \times 4p(1-p)^3$

5.d) Option 2: Efficiency $= p(success\ in\ a\ slot) = 4p(1-p)^3$

Task 6

6.d) Option 4: 840 Mbps (two and two computers in each department and the two servers → 120 * (2*3 +1)