NWEN 302 Assignment 2

1. **A)** 2 subnets
   B) Entry 1:
   Destination: 111.111.111.112
   Gateway: 111.111.111.110
   Entry 2:
   Destination: 222.222.222.220/24
   Gateway: 222.222.222.220
   C)
   Entry 1:
   Destination: 111.111.111.111
   Gateway: 111.111.111.110
   Entry 2:
   Destination: 111.111.111.112
   Gateway: 111.111.111.110
   Entry 3:
   Destination: 222.222.222.221
   Gateway: 222.222.222.220
   Entry 4:
   Destination: 222.222.222.222
   Gateway: 222.222.222.220
   D)
   Given that the datagram has been handed to the link layer and the ARP tables are stated to be empty, then that means this datagram should be an ARP request that contains the source IP (111.111.111.111) and MAC (74-29-9C-E8-FF-55) address and the destination IP address (111.111.111.112) , this is handed to the physical layer as a frame.
   This frame arrives at the router and the router updates its ARP table to know the sender IP and MAC mapping, it is then sent out by the router to all connections, and is ignored if the destination address is not matching (or known).
   When the packet arrives at the destination, then the destination ARP table is updated with the IP mapping of the source, and an ARP response is prepared containing the source IP (111.111.111.112) and MAC (CC-49-DE-D0-AAB-7D) and the destination IP (111.111.111.111) and MAC (74-29-9C-E8-FF-55).
   This is sent back out, the router receives it and checks against the ARP table, which has the mapping for 111.111.111.111 and sends it back.
   The initial datagram can now be sent as the original source now knows the ARP mapping of the destination.
   E)

2.

- **A)** Kb = 1*512, Detection at 245 bit times, Kb backoff = 512 bit times.
  245+245+512+96 = 1002 bit times for B retransmission.
- **B)** 245+245+96 = 586 bit times.
- **C)** Transmit time from A = 586, propagation delay = 245.
  586 + 245 = 831 bit times. The difference between receiving A and retransmitting from B is more than the idle time (1002-831=171) so B can transmit.

3.

A) Infrastructure mode is a framework where a device communicates through an access point. If not in infrastructure mode, then it would be in ad hoc mode where the devices connect to each other, peer-to-peer. Infrastructure mode allows the wireless devices to communicate with all devices on a given network including wired and wireless, ad hoc connections are only available to other wireless devices and are limited by the transmission capabilities of said devices.

B) "**Path loss**, or **path attenuation**, is the reduction in power density (attenuation) of an electromagnetic wave as it propagates through space." This is most notable through solid matter.

Multipath propagation is the phenomenon that results in radio signals reaching the receiving antenna by two or more paths. Such as the radio signal reflecting off ground objects, these signals can then arrive at different times.

Interference from other sources is when other sources are also transmitting on the same frequency, this is a common case in households with multiple devices connecting via 2.4GHz.

C) Acknowledgements are used to confirm that data has successfully been transmitted without error, due to the high amount of loss caused by path loss, multipath propagation, interference and such.

4. **A)**

$E'(p) = N(1-p)^{N-1} - Np(N-1)(1-p)^{N-2}$

$= N(1-p)^{N-2}((1-p) - p(N-1))$

When $E'(p)=0$

Then $p^* = \frac{1}{N}$

B)

$E(p^*) = N \cdot \frac{1}{N}(1-\frac{1}{N})^{N-1}$

$= (1-\frac{1}{N})^{N-1}$

$= \frac{(1-\frac{1}{N})N}{1-\frac{1}{N}}$

$\lim_{N\to\infty} (1-\frac{1}{N}) = 1$

$\lim_{N\to\infty} (1-\frac{1}{N})^N = \frac{1}{e}$

$\lim_{N\to\infty} E(p^*) = \frac{1}{e}$