Problem 1

In this problem, you will put together much of what you have learned about Internet protocols. Suppose you walk into a room, connect to Ethernet, and want to download a Web page. What are the protocol steps that take place, starting form powering on your PC to getting the Web page? Assume there is nothing in our DNS or browser caches when you power on your PC. Explicitly indicate in your steps how you obtain the IP and MAC addresses of a gateway router.

Write your solution to Problem 1 in this box

① After powering on, the computer uses DHCP to obtain an IP address.
   1) first create a special IP diagram to 255.255.255.255 in DHCP server
   2) puts the diagram in a Ethernet and starts broadcasting
   3) Follow the steps in DHCP and get an unique IP for a certain time.

② Acquire the address of local DNS server

③ After powering on, the ARP cache is empty. aquire MAC address of the first-hop router through ARP protocol

④ Use DNS protocol to acquire IP address of the webpage.

⑤ Send HTTP request to the web server
   1) first TCP connection
   2) upon TCP, builds up IP/UDP connection

⑥ request/respond TCP IP packets with IP protocols.

Problem 2

Suppose there are two ISPs, providing WiFi access in a particular cafe, with each ISP operating its own AP and having its own IP address block.

(a) Further suppose that by accident, each ISP has configured its AP to operate over channel 11. Will the 802.11 protocol completely break down in this situation? Discuss what happens when two stations, each associated with a different ISP, attempt to transmit at the same time.

(b) Now suppose that one AP operates over Channel 1 and the other over Channel 11. How do your answers change?

Write your solution to Problem 2 in this box

a. Theoritically, the two ISPs can work in parallel over the same channel, but they share the same wireless bandwidth. So, no 802.11 will not completely break down.

For two APs, MAC address and SSIDs are different. Therefore, when a station is ~~asso~~ associated to a AP, and sends a frame, the other AP can also receive the frame, but will not process it.

b. Data collisions between the two APs are avoided, thus overall performance is largely improved.

802.11 will not be break down.

Problem 3

In Mobile IP, what effect will mobility have on end-to-end delays of datagrams between the source and destination?

Write your solution to Problem 3 in this box

It will impose additional delay due to indirect routing from the corresponding home agent to the mobile correspondent.

Because datagrams have to be transmitted to home agent before ~~forwarded~~ forwarded to the mobile.

However, depending on the delays on multiple paths between source and destination, it's possible that direct delay is smaller than delay source → home agent plus delay home agent → dest.

Problem 4

Consider the hierarchical network in Slide 6-84 and suppose that the data center needs to support email and video distribution among other applications. Suppose four racks of servers are reserved for email and four racks are reserved for video. For each of the applications, all four racks must lie below a single tier-2 switch since the tier-2 to tier-1 links do not have sufficient bandwidth to support the intra-application traffic. For the email application, suppose that for 99.9 percent of the time only three racks are used, and that the video application has identical usage patterns.

(a) For what fraction of time does the email application need to use a fourth rack? How about for the video application?

(b) Assuming email usage and video usage are independent, for what fraction of time do (equivalently, what is the probability that) both applications need their fourth rack?

Write your solution to Problem 4 in this box

a. email application : $\frac{100 - 99.9}{100} = 0.001$

$= 0.1\%$

video application : same pattern

thus also 0.1%

b. Since they are independent

$0.001 \times 0.001 = 0.00001$

Problem 5

Answer the following questions:

(a) What is the role of the core network in the 3G cellular data architecture?

(b) What is the role of the RNC in the 3G cellular data network architecture?

(c) What role does the RNC play in the cellular voice network?

Write your solution to Problem 5 in this box

(a) core network connects radio access networks to the public internet.
It interoperates with existing cellular voice network, such as MSC, etc.

(b) RNC connects to circuit-switch cellular voice network through MSC
" " to packet-switch network through SGSN.
RNC governs several cell base stations at the same time.

(c) It connects cellular voice network through MSC.
(circuit-switch)
Although voice service and data service are based on different core networks, RNC allows them to share a common first/last-hop radio access network.