

CMSC3180: Data Communication and Networking

Assignment 7 Due on Friday (12/6) midnight

Policies:

1. Discussions on these questions are welcomed and encouraged. However, you should NOT ask any other person to write solution for you or copy solutions from any other person directly. You should write the names of the persons from whom you received help and cite the references used if any.
2. Late turn in will cause a 10% deduction on your grade for each late day.

Question 1 (5 points). What are the differences between Wireless and Mobility? Also provide one real life example for each.

- Both Wireless and Mobility serve crucial tasks for computer networking, but these two functions have some differences that prove the need for both. To start, Wireless is the communication over a wireless link. Wireless uses radio waves to build this connection in the form of Wi-Fi, LAN, Cellular and Bluetooth. Hosts in the wireless network can be stationary, mobile, or a device in IoT. A wireless network typically has a range depending on the system in place. This range happens because of the attenuation of radio signals, multipath propagation, hidden terminals, and noise interference. Another feature that wireless provides is CDMA. This allows multiple users to cohabitate and transmit messages with minimal network interference. A real-life example of Wireless would be a router in a house. This router provides a network for all home devices such as laptops and smartphones to connect to while in proper range.

- Mobility is the handling of a mobile user who changes point of attachment to network. Mobility answers the question of how a network will know to forward packets to the new network. Mobility provides this network scalability. Using a cellular provider's HSS to store identity and info, mobility allows the connection of devices to alternate networks. The Home network and Visted network system enable this handover. Roaming agreements with ISP's play a crucial role in mobility's functioning. A real-world example of Mobility would be driving on a road trip while making a phone call. The user would notice their phone continuing with the call and not loosing connection when covering many miles of distance between base stations. Mobility enables communication nationally and internationally!

Question 2 (10 points) Consider the single-sender CDMA example in the figure on slide 7-20 with a CDMA code being $(-1, 1, 1, 1, -1, -1, -1, 1)$ and the sender wants to send data “101” to a receiver.

a). Briefly explain what will be the sender’s outputs

- The sender will encode the data 101 with CDMA code to create the chipping sequence. The bits will be flipped, negative turns into positive and positive into negative. 1 will be $(-1, 1, 1, 1, -1, -1, -1, 1)$, 0 will be the negation $(1, -1, -1, -1, 1, 1, 1, -1)$, and the last 1 will be $(-1, 1, 1, 1, -1, -1, -1, 1)$.

b). Briefly explain how does the receiver, when receiving sender’s outputs, recover the original data “101”

- The receiver then uses this unique code to decrypt the data back into a readable message. It starts by multiplying the unique CDMA code for the sender by the received sequence. Then it sums the result. If the sum of the positive bits matches the sum of the negative bits, when divided, it will produce the same sign (example: $+8/+8 = +1$). Hence a positive sum indicates a 1 and a negative sum indicates a 0. Using the formula provided on slide 7-20, we can recover the data bits from the encoding with this method.

Question 3 (15 points)

(1) What statistics analysis could break the Monoalphabetic cipher on slide 8-12?

- Frequency Analysis could break the Monoalphabetic cipher since it is the mapping of common letters in the plain text to the cipher text. The frequency system of mapping from a set of 26 letters to a set of 26 letters also is point that relates to how it is decrypted.

(2) To address the problem in (1), a more sophisticated encryption is proposed on slide 8-13. Assume that three substitution ciphers M1, M2 and M3 are provided below. The cycling pattern is M1M3M2M1; M1M3M2M1; ...

What will be the cipher text for plaintext “bobdidi”?

- Cipher Text = lxkcxorg

M1:

a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	z
n	i	j	c	b	p	i	s	x	e	t	o	m	h	z	k	a	d	u	q	y	v	w	f	g	r

M2:

a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	z
j	k	d	e	f	s	w	y	r	q	o	n	g	u	v	c	m	h	t	z	l	x	b	i	p	a

M3:

a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	z
p	a	i	o	t	k	j	g	m	s	f	l	c	z	x	v	n	u	r	y	q	d	b	w	e	h