

COMP4097 Mobile Computing Assignment 2

Due: Nov 27, 2019 (before 12:30)

1. Hamming Code (7, 4)

a) Referring to the class notes on Hamming Code, when Device A wants to send the following bit sequence “10001010” to Device B using Hamming Code (7, 4), what will be the out-going bit sequence of Device A? You may assume the format of the out-going sequence is: (6 marks)

m7 m6 m5 P4 m3 P2 P1

where mX are the message bits and PX are the parity bits.

b) If Device B receives the following TWO messages from Device A using Hamming Code (7,4), (7 marks)

Message 1 “1011011” and Message 2 “1011010”

Check if there is any error during the two transmissions, and what is the original message Device A wants to send to Device B?

c) What if the channel has a spike and Message 1 & Message 2 received by Device B are as follows: (7 marks)

Message 1 “1100111” and Message 2 “1011010”

What will be your conclusion at the receiving side (i.e. Device B)?

2. Given the following table on Bluetooth transmission:

Packet Type Summary

no. of slots	SCO link	ACL link	user payload (bytes)	symmetric rate (kbps)	asymmetric rate (kbps)
1	-	DM1	0-17	108.8	108.8 / 108.8
1	-	DH1	0-27	172.8	172.8 / 172.8
3	-	DM3	0-120	256	384 / 54.4
3	-	DH3	0-180	384	576 / 86.4
5	-	DM5	0-224	286.7	477.8 / 36.3
5	-	DH5	0-339	432.6	723.2 / 57.6
1	HV1	-	10	64	64 / 64
1	HV2	-	20	64	64 / 64
1	HV3	-	30	64	64 / 64

Remark:

An HV1 packet has to be sent at every two time slots (i.e. 625us x 2).

An HV2 packet has to be sent at every four time slots.

An HV3 packet has to be sent at every six time slots.

- a. Calculate the forward and reverse rates between a Bluetooth master and a Bluetooth slave if an ACL link of DM5/DM1 has been set up. (5 marks)
- b. If such a data transmission channel is setup between two iPhones for sending a 2Mbyte photo from one phone to another, how long will it take to complete the transfer? (5 marks)
- c. If such a data transmission channel is setup between the Bluetooth master (a mobile phone) and a Bluetooth slave (a headset), can this channel support listening to high quality (256kbps) or professional grade (512kbps) mp3 music? Explain why and what may happen? (5 marks)
- d. If we setup a SCO Link of HV3 between the Bluetooth master and slave, can this channel support listening to high quality mp3 music? Explain why and what may happen? (5 marks)

3.a Assume the below cellular network has a frequency reuse factor of 7. The radius of each cell is 1km. (1) Please assign frequencies of {1, 2, 3, 4, 5, 6, 7} to the cells. (2) What is the total geometrical area covered by the cellular network? You only need to count the area inside the hexagons. (5 marks)

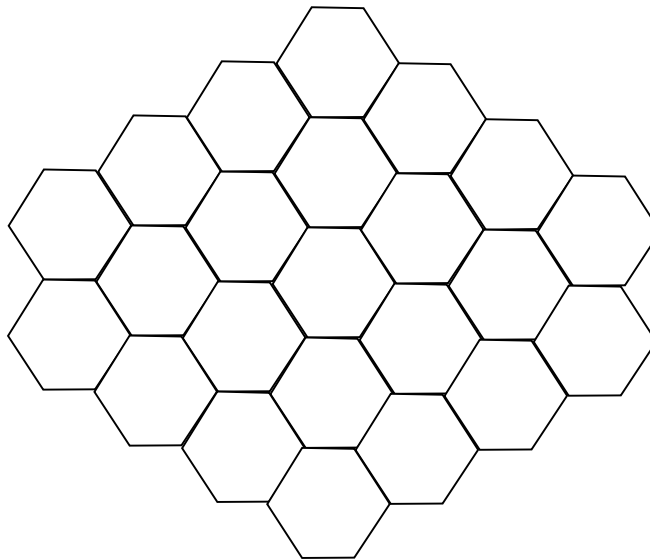


Figure 1. Cell Layout on Frequency Reuse

3.b Explain why using small cells can improve the system capacity of cellular networks. (5 marks)

4. Describe the paging step during a typical mobile phone call. (10 marks)

5. Code Division Multiple Access

Given the following Chipping Codes for users A, B and C.

Chipping Code (k = 4)	1	2	3	4
User A	-1	-1	-1	-1
User B	-1	-1	1	1
User C	-1	1	-1	1

- a) Show that the three Chipping Codes are orthogonal among each other. (6 marks)
- b) If User A is sending “101”, User B is sending “111” and User C is sending “011” at the same time, what will the Sending Signal “Signal D” look like on the common channel? (10 marks)
- c) If User B is communicating with User A, and has just received “Signal D” from part b) above, show how User B can decode the Received “Signal D” and get what User A had sent to User B. (5 marks)
- d) Do the same thing for part c) but to show what User B has sent to User C when C received the same “Signal D”. (5 marks)

6.a Convert the DMS format of a GPS coordinate $\langle 22^{\circ}15'16.9", 113^{\circ}54'15.0" \rangle$ into the decimal degrees format. Find the name of this location from Google Map. (4 marks)

6.b Explain in your own words, how GPS-device can be located by utilizing signals from the satellites. (10 marks)

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