This is Test 2 from 2013. Note that different may have been covered. This year's test will be multiple choice.

PRINCIPLES OF COMPUTER NETWORKS
COMP 3203
TEST 2

Evangelos Kranakis

Name:	
ID #:	
Department:	

1. Put your name and ID at the bottom of every page.
2. Duration: 60 minutes.
3. Answer all questions on the exam paper and in the space provided.
4. Show your work but be precise, concise and clear.
5. Closed books, No notes, No calculating devices of any kind.
6. Use the back pages for scratch.
7. You are not allowed to talk/whisper or look at somebody else's test during the exam.
8. Use alternate seating, if space permits.

1 [10 pts]

1.1 [6 pts]

A system has an n-layer protocol hierarchy. Applications generate messages of length M Bytes. At each level of the layers, an h-Byte header is added.

1. **[3 pts]** What fraction of the network bandwidth is filled with headers? (Give the formula.)

2. **[3 pts]** Now assume $M = 20h$. What should the max number n of layers be so that the fraction in previous Question 1 does not exceed 10 % of the total?

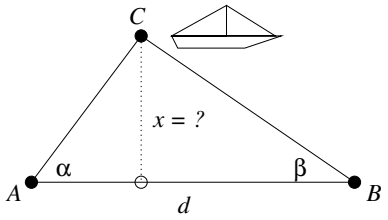
1.2 [4 pts]

Two CDMA users are assigned the 9-bit vectors $A = 110011011, B = 100101111$, respectively. Are they orthogonal? (Prove or disprove!) **Hint:** Recall $0 \to -1$ and $1 \to +1$.

ID#:	Name:

2 [5 pts]

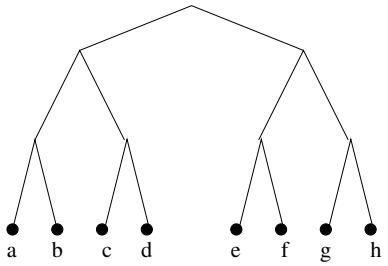
You are observing a ship from two base stations A, B. Assume that at this time of observation $\alpha = \pi/3, \beta = \pi/4$ and $d = 1000\ m$.



Derive a formula for the unknown distance x (You are not required to evaluate the trigonometric functions of $\pi/3$ and $\pi/4$).

3 [5 pts]

Ethernet stations a, b, c, d, e, f, g, h contend for a channel. Assume a, e, f, g, h become ready at once and that they use the tree resolution protocol to resolve contentions.



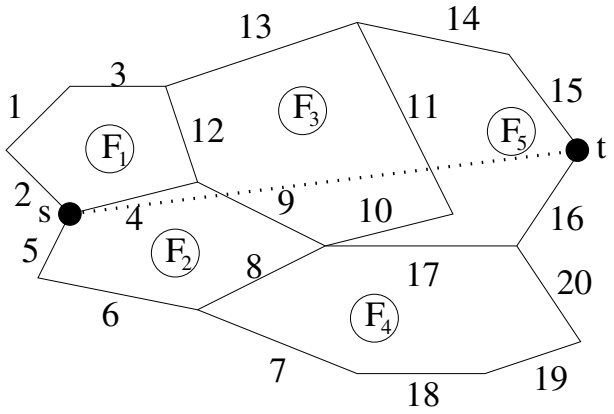
for each contention slot give in the table below the winning stations.

Slot #	List of Winning Stations
Slot 1.	
Slot 2.	
Slot 3.	
Slot 4.	
Slot 5.	
Slot 6.	
Slot 7.	
Slot 8.	
Slot 9.	

ID#:	Name:

4 [10 pts]

The links and faces of a planar wireless network are labeled as depicted in the Figure below. Moreover there is a source node s and a destination node t.



4.1 [6 pts]

Apply the face routing algorithm with the left-hand rule (on a face) to give a path from s to t. In the table below name the face and the edges of that face being traversed. **Your answers must list all the links traversed and the paths formed must arise from the corresponding routing algorithm!**

Face	List of Edges Being Traversed Using Face Routing

4.2 [4 pts]

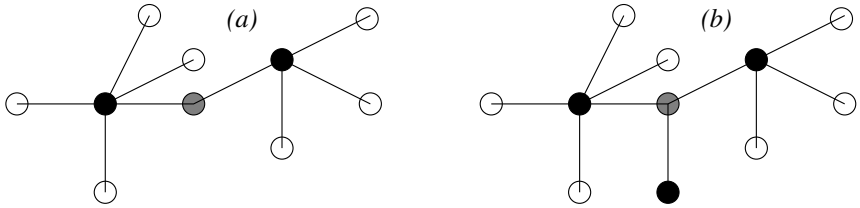
Apply the compass routing algorithm to give a path from s to t.

List of Edges Being Traversed Using Compass Routing

ID#:	Name:

5 [6 pts]

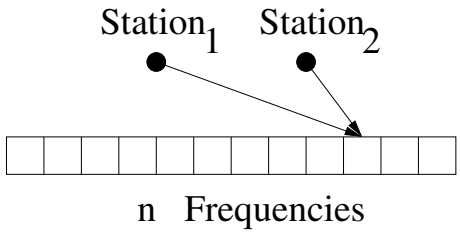
In the networks below empty (gray, black) bullets are pure slaves, bridges, masters, respectively. According to Bluetooth formation rules, which of the two networks are bluetooth networks, which are not and why?



Network	Yes or No	If the answer is NO explain why
(a)		
(b)		

6 [4 pts]

There are $n \geq 2$ possible frequencies and 2 synchronous wireless stations. Each station is using frequency-hoping to select at random (with probability $1/n$) one of these frequencies. What is the probability that the stations select the same frequency? (Give explanation of your answer.)



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7 [5 pts]

n sensors all having range equal to 1, form a unit line graph arranged on a line such that the ith sensor has x-coordinate equal to x_i, for $i = 1, 2, \ldots, n$. Further, assume $x_i = i + (-1)^i$, for all $i = 1, 2, \ldots, n$.

1. **[3 pts]** Give the values

$$\begin{aligned} x_1 &= \\ x_2 &= \\ x_3 &= \end{aligned}$$

2. **[2 pts]** Is the unit line graph a connected graph? Give a precise explanation of your answer.

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