

CSI 5169 Wireless Networks and Mobile Computing Quiz 1, February 18, 2011

Closed book exam, time: 100 minutes

Name: \_\_\_\_\_ Student number: \_\_\_\_\_

Marking:

Q	1	2	3	4	5	6	7	8	9	10	11
Max mark	6	6	4	6	9	6+6	10	7+5	9	5+5	8+8

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1. What is the major difference between CSMA/CD and CSMA/CA with respect to collision treatment?

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2. Why RFID poses privacy risks for consumers and enterprises?

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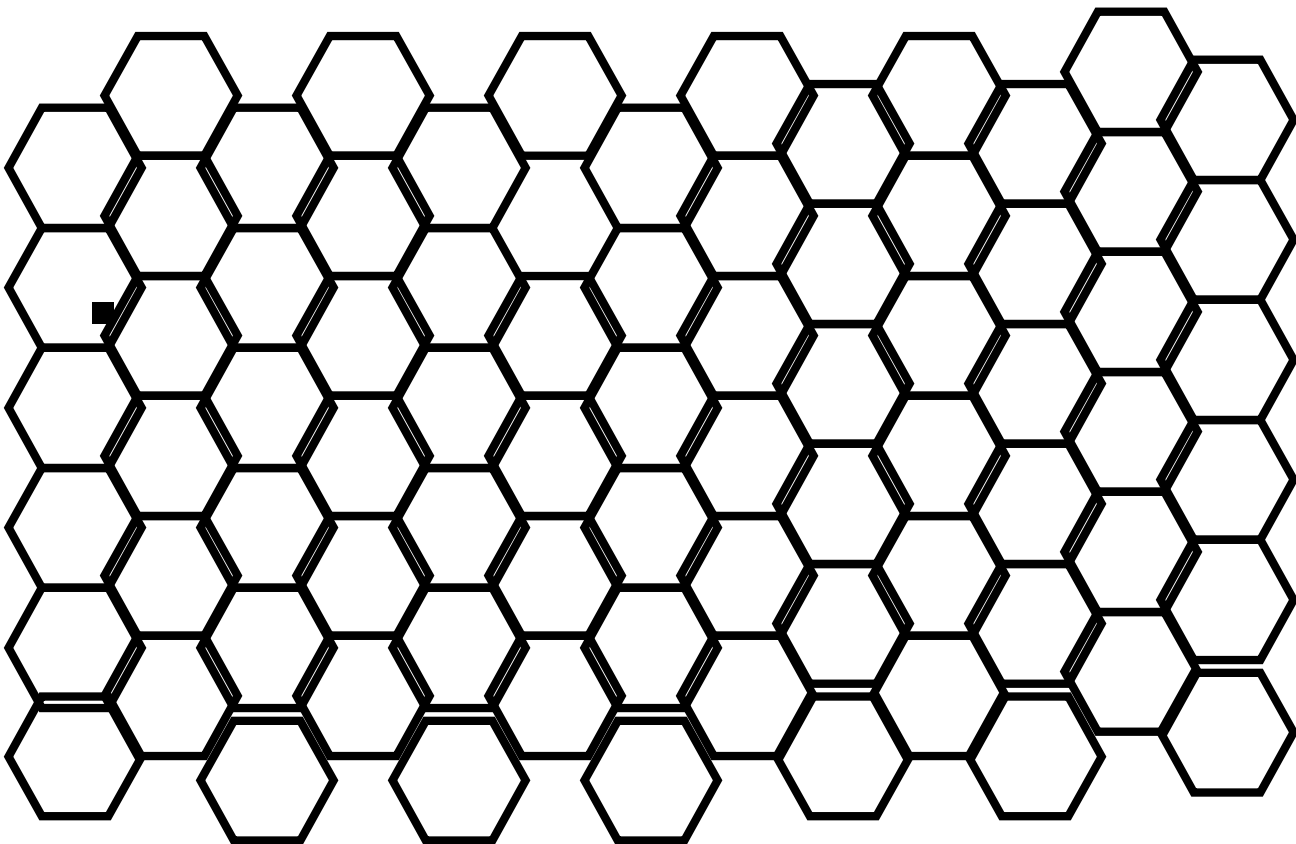
3. Who is the 'father' of radio/wireless communications? The same person invented transformers for long distance transfers of alternate current, and electric motors, which enabled the use of electricity everywhere.

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4. Show on examples how MACA (Multiple Access with Collision Avoidance) avoids hidden terminal and exposed terminal problems.

5. Suppose that a station has selected its backoff time  $B$  in DCF (Distributed Coordinated Function) mode of IEEE 802.11, and channel became busy after initial DIFS period. Explain how the station can decrement  $B$  and when it can be allowed to transmit?

6. Show frequency allocation patterns with reuse distances 4, using minimal number of colors. Use numbers as colors.

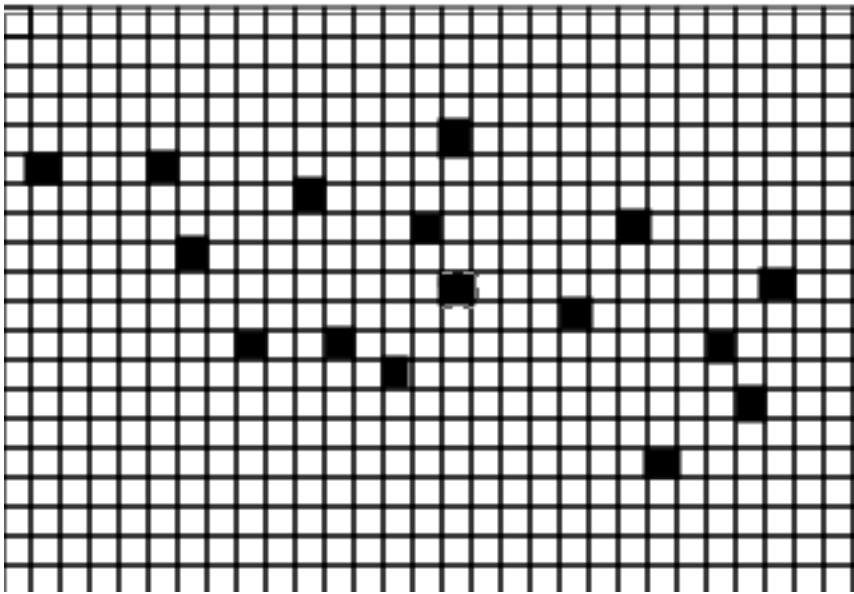


7. Suppose there are only two passive tags to be read by an RFID reader following protocol 2-partition-1. It works as follows (actual algorithm is simplified to be applied only on two tags):

```
nextId=0;
Repeat
~ repeat each tag selects 0 or 1 with probability 1/2;
~     active tag that selected 1 broadcasts → Status1
~
~ until Status1 <> silence;
~ if Status1=single then { NextId ← NextId + 1 };
~ active tag that selected 0 broadcasts → Status0;
~ if Status0 = single then { NextId ← NextId + 1};
~ until NextId=2;
```

- a) What is the probability of getting unique tag transmission?
- b) What is the expected number of rounds (reader requests for ID) for this event to occur?
- c) What is the expected number of rounds (reader requests for ID) to read both tags?

8a. The black squares represent cars. In greedy routing algorithm, message is forwarded to neighbor closest to the destination (and closer to it) among those located within transmission range. Show using arrows how messages can be transmitted from the leftmost car to the rightmost car. Assume the transmission range to be 10. Distance between two cars is measured by counting the number of number of squares between them (consecutive squares share an edge; therefore two squares, sharing only a corner, are at distance 2).

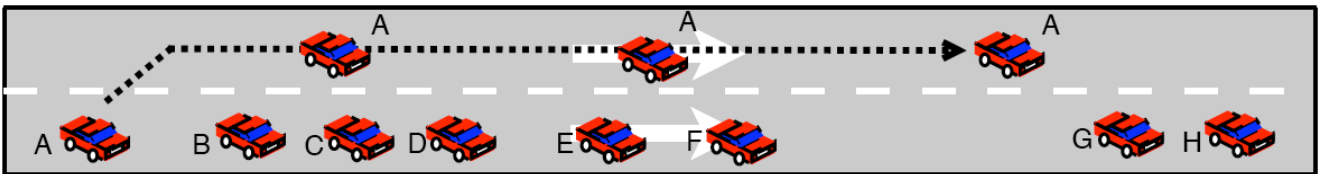


8b) Give an example of a situation where greedy algorithm you use fails, although source and destination cars are connected.

9. Parameterless reliable broadcasting (Ross, Ruiz, Stojmenovic, 2009) works as follows:

1. Beacons used by cars to decide whether or not they belong to a connected dominating set (CDS).
2. Vehicles in CDS use shorter waiting period before possible retransmissions.
3. Identifiers of circulated broadcast messages are added to beacons as *piggybacked acknowledgements*.
4. When waiting timeout expires, *vehicle retransmits if it has at least one neighbor which did not acknowledge circulated message with the last beacon*, and sets a new waiting period.

In Figure below, there are two clusters: BCDEF and GH, while car A moves as indicated. Suppose that A is the source of a message when it started the manoeuvre (at the left end). Also assume that transmission radius allows at most position of A to transmit to B, B to send to C and D, D to E only, E to F, and G to H (this is symmetric of course). CDS nodes are B,D,E and H. Which cars retransmit? How many times A retransmits and at what locations? Explain by tracing the algorithm.

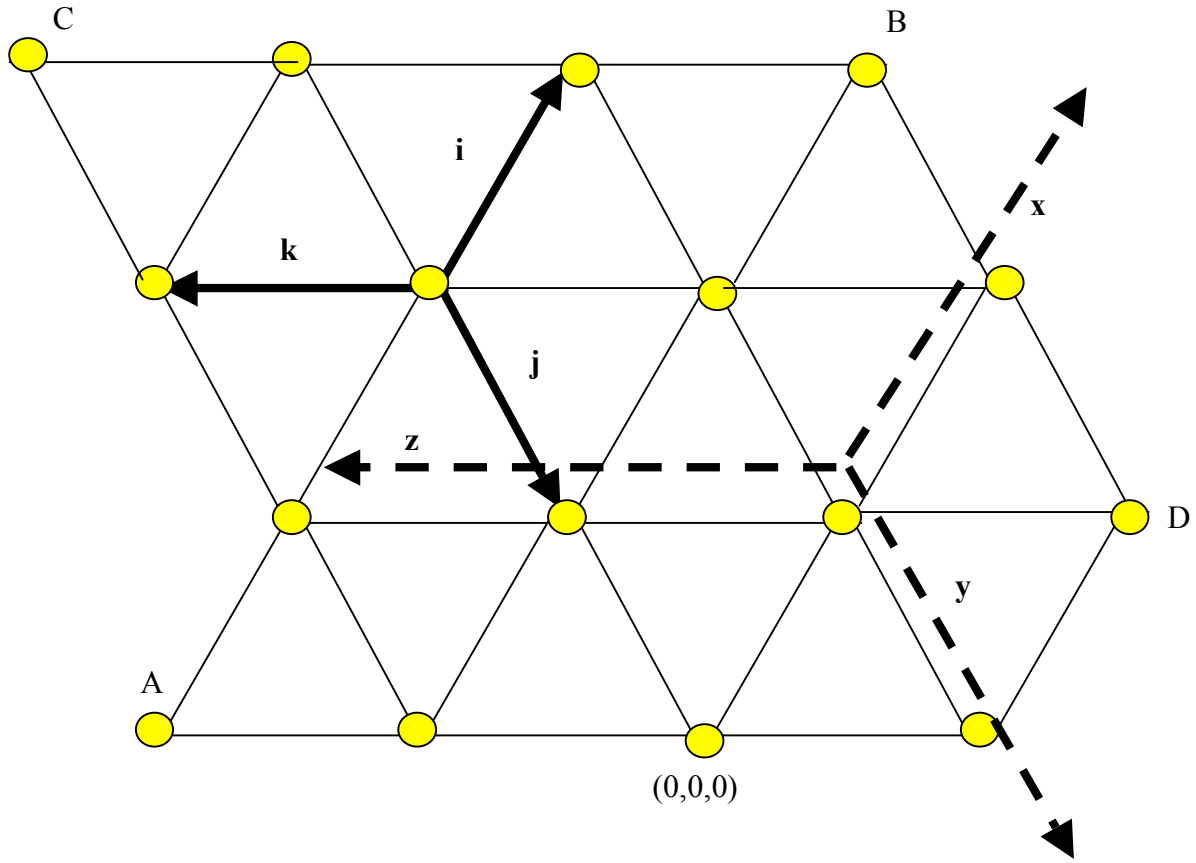


10. Consider fixed channel allocations with reuse distance 2. Let  $D$  be the maximum number of channels ever needed in a node or 3-cycle (triangle of base stations).

a) explain briefly the allocation of  $3D/2$  channels to accommodate all calls, and how is this achieved (borrowing scheme).

b) explain briefly the allocation of  $4D/3$  channels to accommodate all calls, and how is this achieved (borrowing scheme).

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 11.



- What are the coordinates of nodes A, B, C and D in the unique shortest path representation?
- Give necessary and sufficient condition for  $(a,b,c)$  to be a unique shortest path representation of a node. Explain briefly this condition (no need for technical derivations).