EE 706: Communication Networks

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Code A

Quiz 3 : **15 points** (45 min) March 11, 2011

0. Write down the code of your question paper next to your roll number. [0 points]

1. Given a choice between TDMA, FDMA and ALOHA, which MAC protocol is better for the following scenarios. If you think more than one protocol is appropriate, then mention them and explain. [5 points]

   (a) Number of sources is fixed. Sources are mobile making slot synchronization difficult. All sources generate traffic at a constant rate.

   (b) Number of sources is fixed. Source locations are fixed making slot synchronization easier than the mobile source case. All sources generate traffic at a constant rate.

   (c) Number of sources is varying. Source locations are fixed making slot synchronization easier than the mobile source case. Sources generate traffic in a bursty manner, i.e. only some sources have data to transmit at the same time.

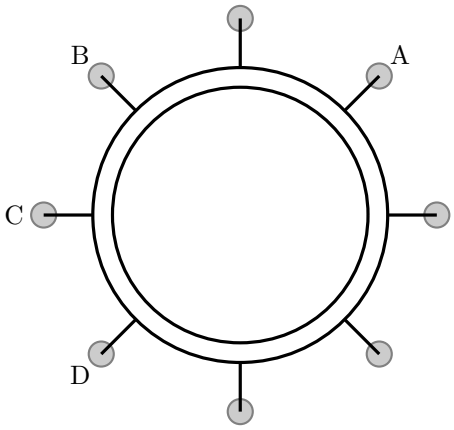
   (d) Number of sources is varying. Sources are mobile making slot synchronization difficult. Sources generate traffic in a bursty manner, i.e. only some sources have data to transmit at the same time.

   (e) Number of sources is fixed. Source locations are fixed making slot synchronization easier than the mobile source case. Sources generate traffic in a bursty manner, i.e. only some sources have data to transmit at the same time.

2. Consider the token ring network shown in Figure. Suppose node A has frames F_1, F_2 to transmit to node C. Suppose node C replies to these frames with ACKs A_1, A_2 respectively when it gets a chance to transmit. Suppose node B has frames F_3, F_4 to transmit to node D. Suppose node D replies to these frames with ACKs A_3, A_4 respectively when it gets a chance to transmit.

   (a) Suppose the token is initially with A and is passed around in a clockwise manner, what is the sequence of frames/ACKs/token frames observed on the channel? [2.5 points]

   (b) Suppose the token is initially with A and is passed around in a counter-clockwise manner, what is the sequence of frames/ACKs/token frames observed on the channel? [2.5 points]



3. Suppose a source uses type II hybrid ARQ with two codes C_0 and C_1. C_0 is a high rate error detection code with encoding function α which takes as input n information bits and outputs k redundancy bits. C_1 is a rate $\frac{1}{2}$ invertible code which is used for both error correction and detection, i.e. it can detect the situation when it has not been able to correct all the errors in the received bits. Let β be the encoding function for C_1 which takes as input n information bits and outputs n redundancy bits.

   Suppose the source has 10 n-bit information blocks to transmit, $\mathbf{u}_1, \mathbf{u}_2, \ldots, \mathbf{u}_{10}$. Suppose that the source does not experience a timeout in response to every prime numbered usage of the channel, i.e. the source experiences a timeout after the first time it uses the channel to send a frame, does not experience a timeout the second time it uses the channel, does not experience a timeout the third time it uses the channel and so on. What is the sequence of frames which are transmitted by the source? Express the frame transmitted in terms of $\mathbf{u}_i$, $\alpha(\mathbf{u}_i)$, $\beta(\mathbf{u}_i)$, $\alpha[\beta(\mathbf{u}_i)]$ and $\beta[\alpha(\mathbf{u}_i)]$. Here the source is assumed to be using stop-and-wait ARQ, so it does not send the information block $\mathbf{u}_{i+1}$ until the information block $\mathbf{u}_i$ is acknowledged. [5 points]