HKUSTx: ELEC1200.3x A System View of Communications: From Signals to Packets (Part 3)

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Section 1 Question 1

(2/2 points)

For each of the descriptions below, please indicate the corresponding networking layer.

This layer is responsible for routing packets so that they get to their correct destinations.

Networking ▼ ✔

Architectures used in this layer include client-server and peer-to-peer.

Application ▼ ✔

This layer is often responsible for ensuring reliable and in-order packet delivery.

Transport ▼ ✔

Protocols running on this layer control access to a shared communication medium.

Link ▼ ✔

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Final Exam
Final Exam due Feb 22, 2016 at 15:30 UTC

- MATLAB download and tutorials

You have used 1 of 1 submissions

Section 1 Question 2

(1/2 points)

Consider a slotted ALOHA system where there are 8 users, each of which transmits with probability p = 0.05, during one time slot.

What is the efficiency of this system? Give your answer to two decimal places (e.g. 0.55).

0.24 ✖ **Answer:** 0.28

0.24

EXPLANATION

The efficiency is given by N*p*(1-p)^(N-1), where N = 8 and 0 = 0.05.

In order to achieve optimal efficiency, should how should the users change their probability of transmission p?

increase p ✔ **Answer:** increase p

You have used 0 of 1 submissions

Section 1 Question 3

(2 points possible)

Consider a slotted ALOHA system with two users, A and B. Each user transmits randomly during each slot, however the probabilities that each user transmits, p_A and p_B, may differ.

Which of the following is the equation for the efficiency of this system?

- $p_A + p_B$
- $p_A(1 - p_A) + p_B(1 - p_B)$ ✖
- $p_A(1 - p_B) + p_B(1 - p_A)$ ✔
- $p_A p_B(1 - p_A)(1 - p_B)$

EXPLANATION

A packet gets through if A transmits and B does not or if B transmits and A does not.

You have used 0 of 1 submissions

MATAB INSTRUCTIONS

The initial MATLAB code in the window below is similar to the code of Lab 1, where we simulated the transmission of the data from 4 users (**n_users**) through a link layer using the ALOHA protocol. You can find the detailed settings of the simulation from the instructions of Lab 1 - Task 1. As shown in Task 4 of Lab 1, the efficiency of the system is a function of the transmission probability **p**. However, to set the optimal transmission probability, the number of users needs to be known. In practice, this is not known and may change over time. In this task, you will write code to update the probability of **p** dynamically.

If you run the code, two figures will be displayed. Figure 1 shows two subplots. The top subplot shows the value of **p** in each iteration. For the initial code, this will be constant, but for the correct code, the value of **p** should change over time. The second subplot shows the efficiency of the algorithm as a function of the time. For the correct code, the efficiency should increase over time until it converges to a stable value around 0.3. Figure 2 shows the theoretical efficiency as a function of the probability **p** and also shows the average probability **p** during the last 500 slots of the simulation as a vertical dotted line. If the code is correct, the average probability should be close to the probability that provides the highest efficiency.

Your task is to revise the initial code to update the probability **p** in every iteration using the binary exponential backoff algorithm introduced in lecture 2.4. Your code should restrict the probability **p** so that it stays between **p_min =0.01** and **p_max = 0.7**. In a practical system, each node would be running this algorithm independently, and updating its own value of **p**. However, for this simulation you should assume that the value of **p** is updated globally, depending upon whether there was a successful transmission or a collision in the frame.

Please, revise the the code between the lines:

% % % % Revise the following code % % % %

and

% % % % Do not change the code below % % % %

to update the probability **p**. Do not change other parts of the code or the values of other variables.

Note that similar to Task 4 of Lab 1, we made some simplifications in this simulation. Specifically, the data users send is always the same and stored in **frame(id,:)** where **id** is a number between 1 and 4 that identifies the user. We assume a binary channel where the state of the channel, **slot**, is obtained by taking the logical OR operation among all frames transmitted. Finally, the correctness of the received packet is checked by the function **checkReceivedFrame**, and we update the number of successfully sent frames (**n_succ**) or the number of collisions (**n_coll**) , accordingly.

Section 1 MATLAB Question

(2/2 points)

```
% parameters
n_slots =1000;
n_users = 4;
p_min = 0.01;
p_max= 0.7;

initSimulation(n_users,n_slots);

p_trace = zeros(n_slots,1);
succ_trace =  zeros(n_slots,1);
```

Correct

```
    if ~isequal(slot,zeros(1,16))
        if checkReceivedFrame(slot,n_users)
            % frame transmitted successfully
            n_succ = n_succ + 1;
            p = min(p_max , p*2);
        else
            % a collision occured
            n_coll = n_coll + 1;
            p = max(p_min , p/2);
        end
    else
        % frame is empty
        n_empty = n_empty + 1; % update the number of empty frames
    end
```

Figure 1

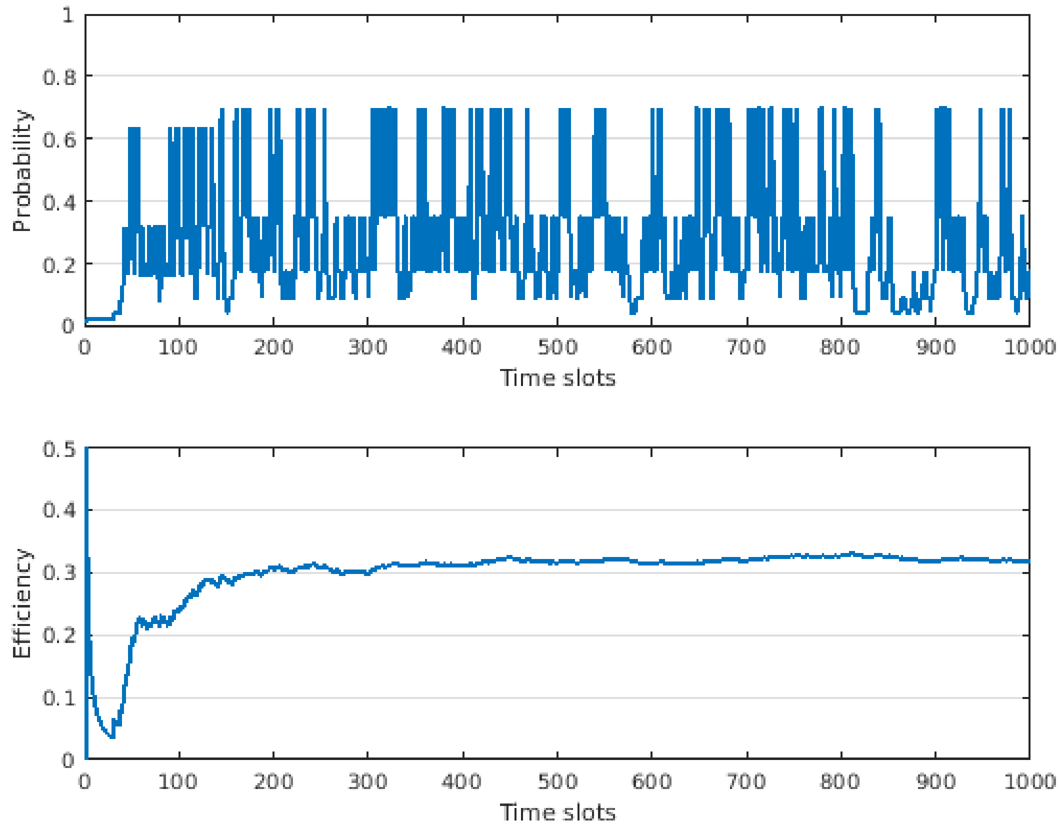
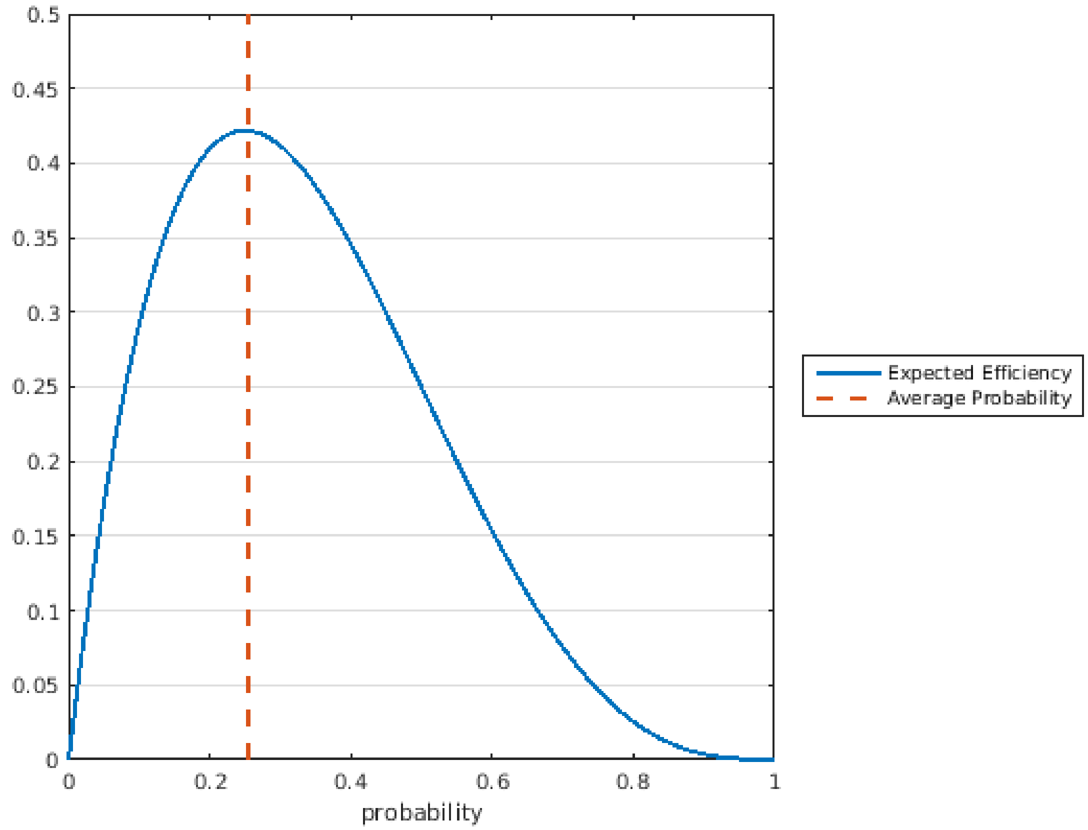


Figure 2



You have used 1 of 5 submissions