ELEC373 Assignment 1

February 15th, 2023 - Curtis Pike (20174323)

# Code

Below is the Matlab code used to simulate the single-server queue and generate a plot based on the simulation. It includes annotated comments describing the functions of each section.

% ELEC373 Assignment 1

figure('Name','Average Queueing Delay');

N = 10 \* 1000000;

service\_rate = 0.75;

arrival\_rate = [0.2, 0.4, 0.5, 0.6, 0.65, 0.7, 0.72, 0.74, 0.745];

queue\_length = [0,0,0,0,0,0,0,0,0];

average\_queue = [0,0,0,0,0,0,0,0,0];

average\_wait = [0,0,0,0,0,0,0,0,0];

% Generate average queue lengths and calculate average queueing delay using

% Little's Law

for i = 1:9

sum = 0; % keeps a total, used for the average at the end of for loop

for j = 1:N

num1 = rand(1); % event of a departure

num2 = rand(1); % event of an arrival

% If there is a packet in the queue and there is a departure

if(num1 < service\_rate & queue\_length(i) > 0)

% subtract 1 from the current queue length

queue\_length(i) = queue\_length(i) - 1;

end

% If there is an arrival

if(num2 < arrival\_rate(i))

% Add 1 to the current queue length

queue\_length(i) = queue\_length(i) + 1;

end

% add current queue length to the total sum

sum = sum + queue\_length(i);

end

% Calculate average queue length based on the sum

average\_queue(i) = sum/N;

% Using Little's Law, calculate the average queueing delay

average\_wait(i) = average\_queue(i)/arrival\_rate(i); % Little's Law

end

plot(arrival\_rate, average\_wait);

hold on;

title("Plot of Average Queueing Delay & Arrival Rate");

xlabel("Arrival Rate (%/timeslot)");

ylabel("Average Queueing Delay (timeslots)");

hold off;

# Plot

This is a plot generated by the code from above. These results are produced consistently.

Graphical user interface

Description automatically generated

Figure : Average Queueing Delay Plot