Report: 62/60
Presentation: 15/20
Codes: 20/20

Total: 97

ECE466 LAB1

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Part1

Exercise 1.1:

Verify the measured mean bit rate of the flow with the target rate, by calculating the mean and the variance of the times between consecutive arrival events. Compare the values with the theoretically expected values

Theoretical bit rate = 1 Mbps
Theoretical arrival time = 100bytes*8/1Mbps = 800 ms

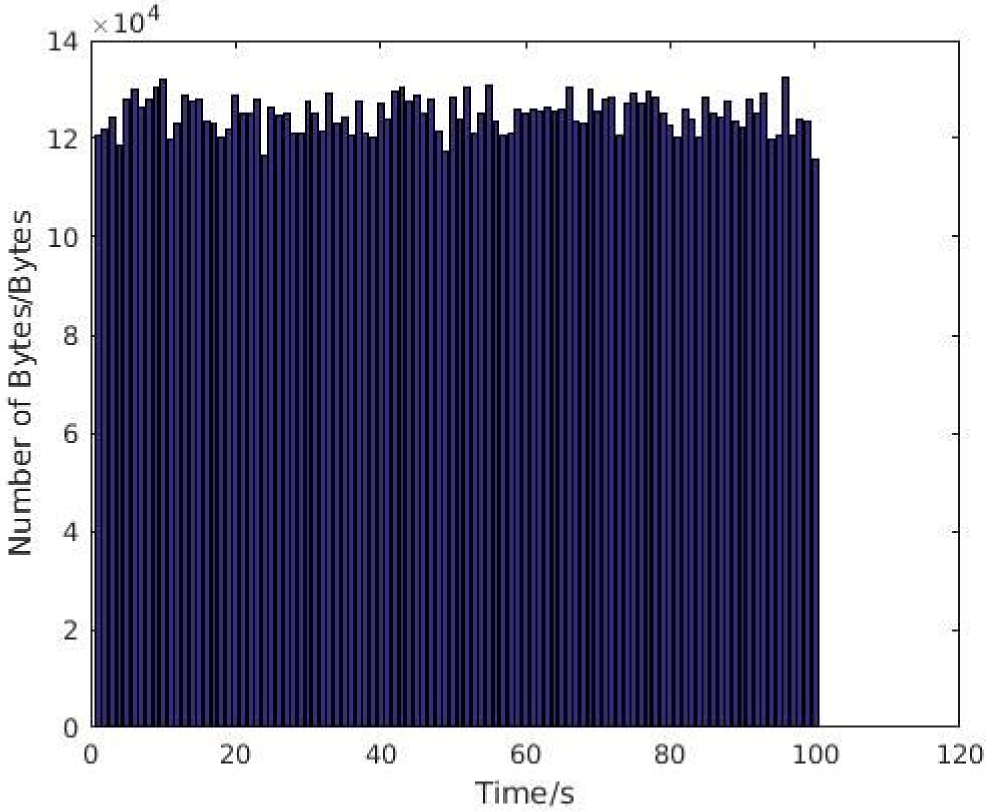
-1: var's unit is (time)^2

Actual bit rate = 1.0006Mbps
Mean time between consecutive arrival events = 799.5114760918087 ms
Variance of the times between consecutive arrival event = 6.405359151449436e+05

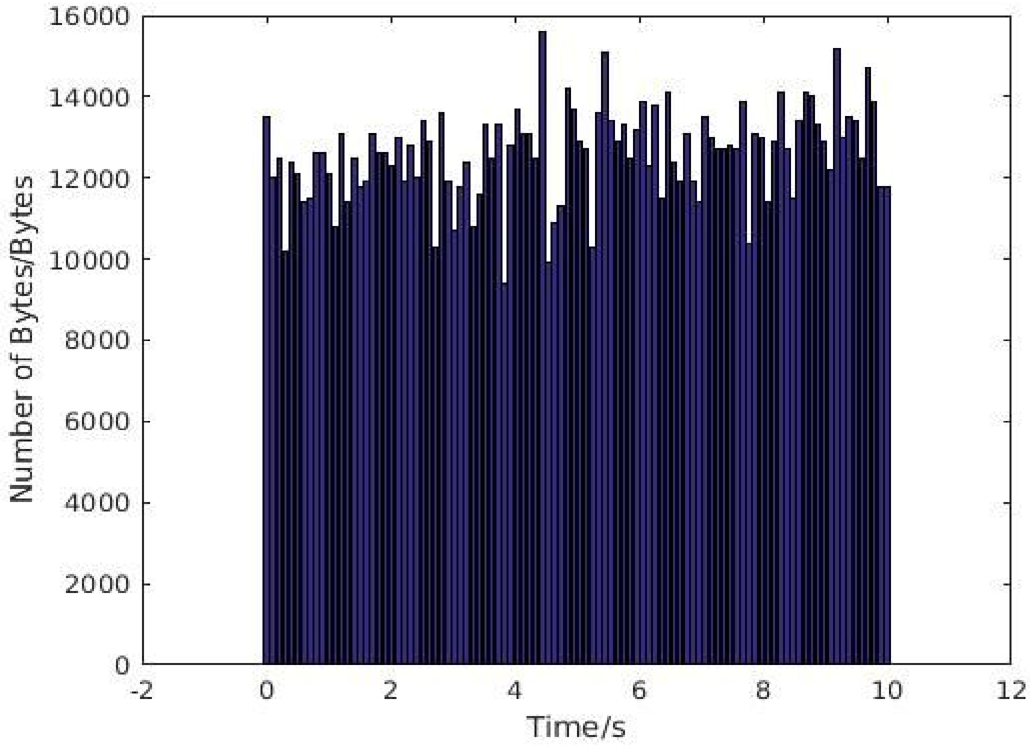
Our computed results are very close to the expected values. And the variance is kind of high, which means that the real results are far varies from mean value.

Create three graphs that plot the data generated by the trace, viewed at different time scales. Each graph has 100 data points.

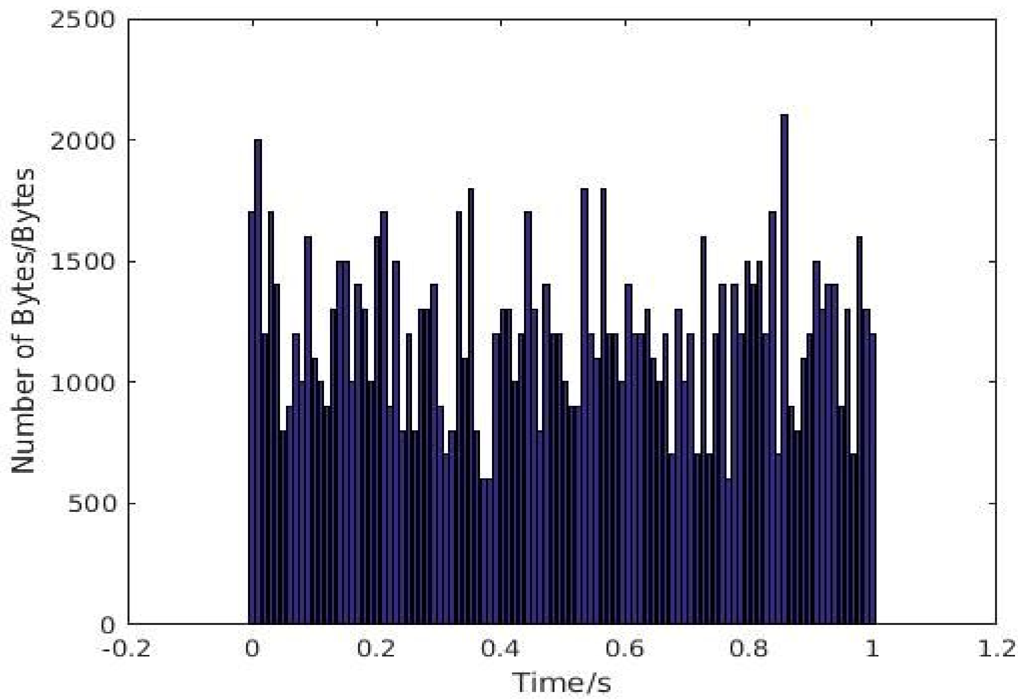
Plot 1: Generate a vector with 100 elements. Each element stores the number of bytes from the Poisson trace that arrive in a time period of 1 second.



Plot 2: Generate a vector with 100 elements. Each element stores the number of bytes from the Poisson trace that arrive in a time period of 100 milliseconds, beginning at a randomly selected start time.



Plot 3: Generate a vector with 100 elements. Each element stores the number of bytes from the Poisson trace that arrive in a time period of 10 milliseconds, beginning at a randomly selected start time.



Describe your observations of the graphs.

As the time interval become more granular, we observe higher variance of number of bytes arrives. When we observe number of bytes in large time interval, the graph has very low variance. The difference between the size of the elements is larger in the small time scale.

Exercise 1.2:

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Exercise 1.3:

Verify the measured mean bit rate of the flow with the target rate, by calculating the mean and the variance of the times between consecutive arrival events. Compare the values with the theoretically expected values.

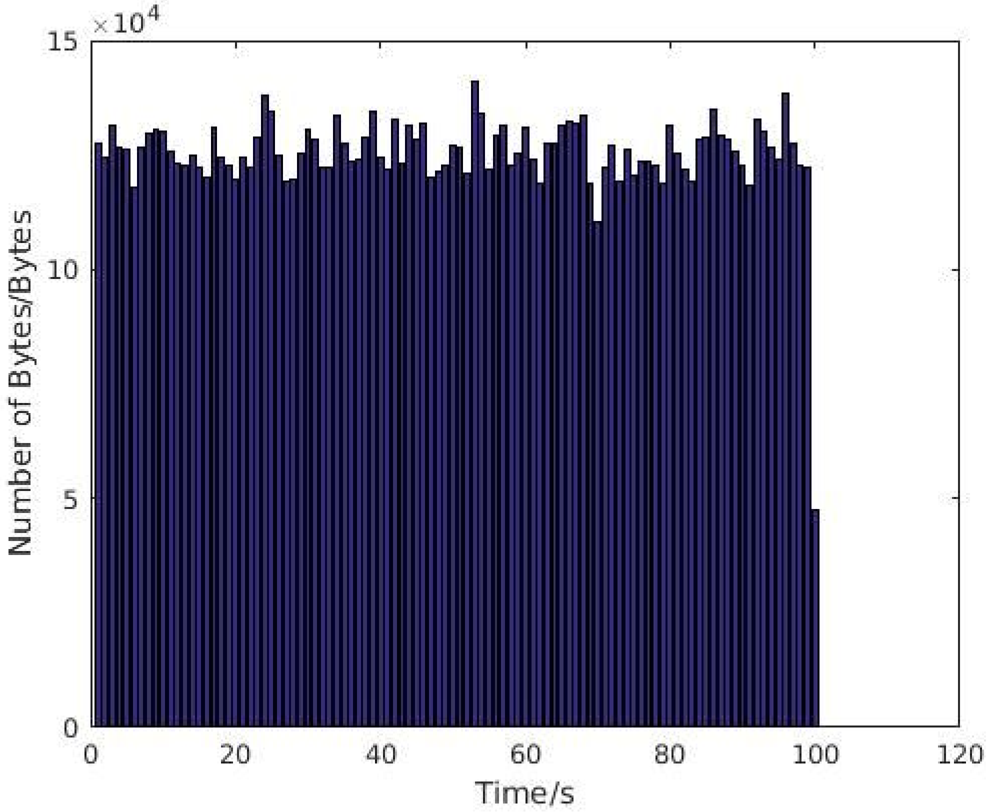
Theoretical bit rate = 1 Mbps
Theoretical arrival time = 800 ms

Actual bit rate = 1.0006 Mbps
Mean time between consecutive arrival events = 795.2037 ms
Variance of the times between consecutive arrival event = 6.318407188154040e+05

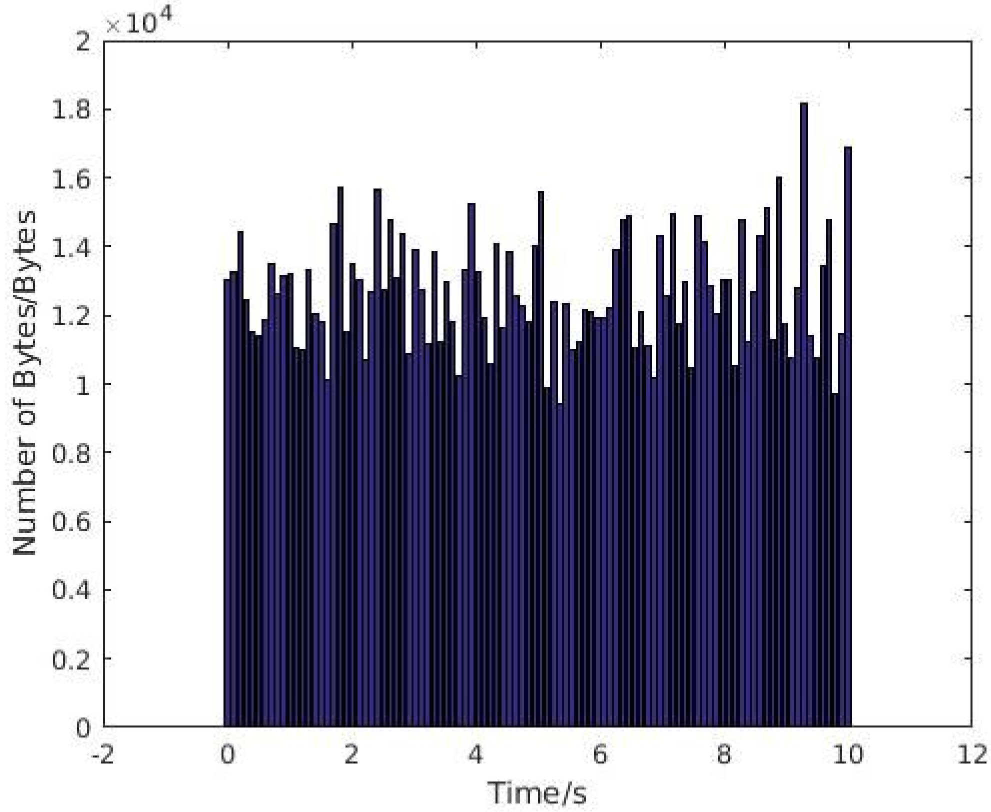
Repeat the tasks in Exercise 1.1 with the above arrival flows.

Plot 1: Generate a vector with 100 elements. Each element stores the number of bytes from the Poisson trace that arrive in a time period of 1 second.

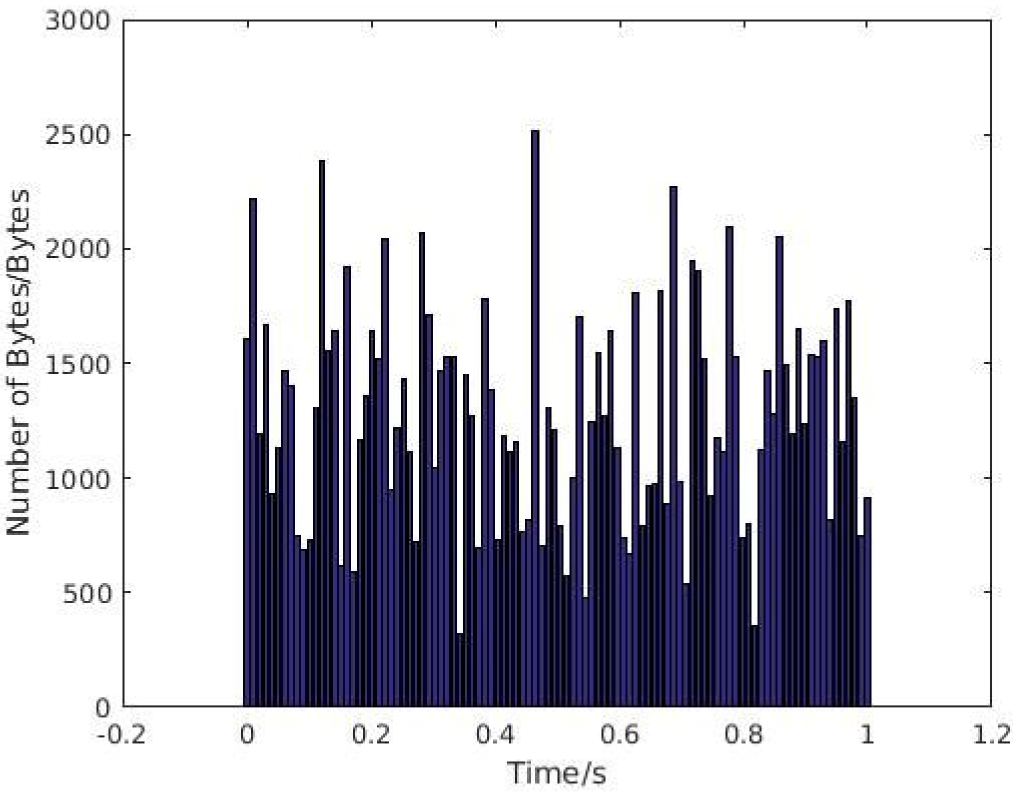
-3: presentation: graphs and plots could be a little smaller and better labeled.



Plot 2: Generate a vector with 100 elements. Each element stores the number of bytes from the Poisson trace that arrive in a time period of 100 milliseconds, beginning at a randomly selected start time.



Plot 3: Generate a vector with 100 elements. Each element stores the number of bytes from the Poisson trace that arrive in a time period of 10 milliseconds, beginning at a randomly selected start time.



Provide a discussion where you compare the results, with those of the other exercises.

The behaviour of the Exercise 1.3 is similar to description of the behaviour in Exercise 1.1. But in the small time scale, we could see that the plot is appeared to be more bursty.

Part 2

Exercise 2.2:

Compute the following properties of the video trace.

- **Number of frames and total number of bytes;**
  - Number of frames = 53997
  - Total number of bytes = 3.209958344000000e+09 bytes
- **Size of the smallest frame, size of the largest frame, and mean frame size;**
  - Size of the smallest frame = 136 bytes
  - Size of the largest frame = 657824 bytes
  - Mean frame size = 5.944697564679520e+04 bytes
- **Size of the smallest, largest and mean I, P, and B frame;**
  - Smallest I frame = 528 bytes
  - Largest I frame = 657824 bytes
  - Mean I frame = 1.837761327407408e+05 bytes
  - Smallest P frame = 156 bytes
  - Largest P frame = 493176 bytes
  - Mean P frame = 1.114125242469136e+05 bytes
  - Smallest B frame = 136 bytes
  - Largest B frame = 368976 bytes
  - Mean B frame = 3.609309548855471e+04 bytes

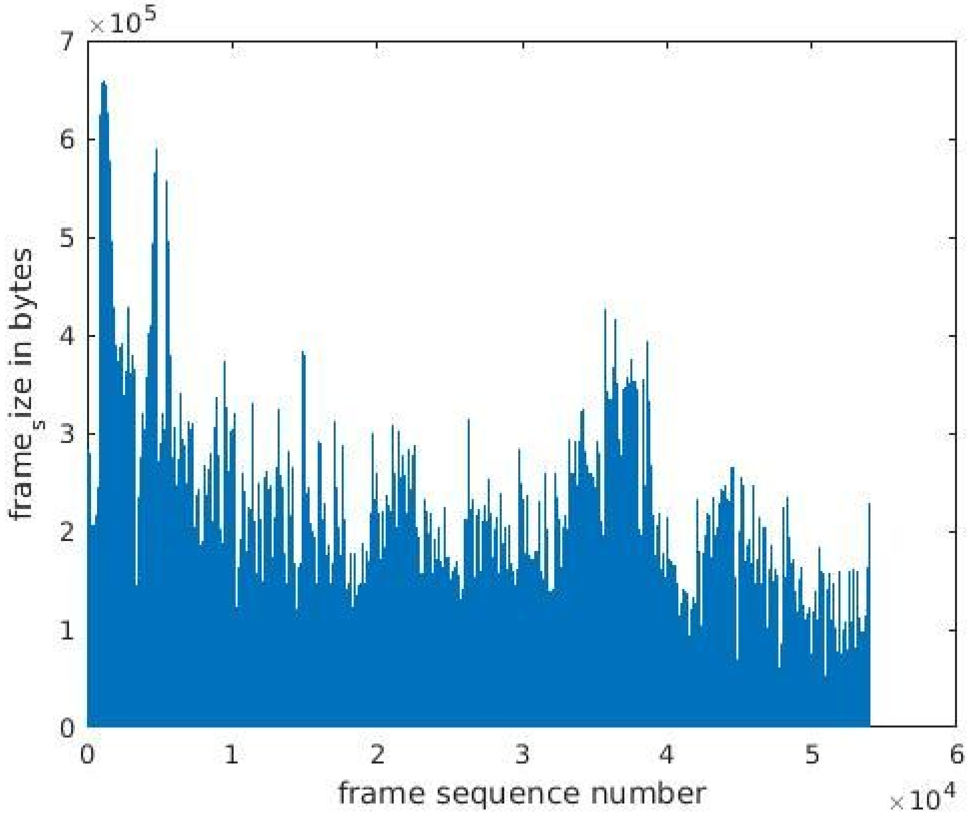
-2: presentation: using a table would be better for presenting data.

- **Mean bit rate (Computed as the mean frame size divided by the frame duration);**
  - Mean bit rate = 1.441138803558671e+01 Mbps
- **Peak bit rate (Computed as the max. frame size divided by the frame duration);**
  - Peak bit rate = 1.594724848484848e+02 Mbps
- **Ratio of the peak rate and the average rate. This peak-to-average rate ratio is often used as an indicator how bursty a traffic flow is. A flow with a peak-to-average ratio of 10 or higher is highly variable.**
  - Ratio of the peak and mean rate = 11.0657

Generate a set of graphs that show the properties of the video trace:

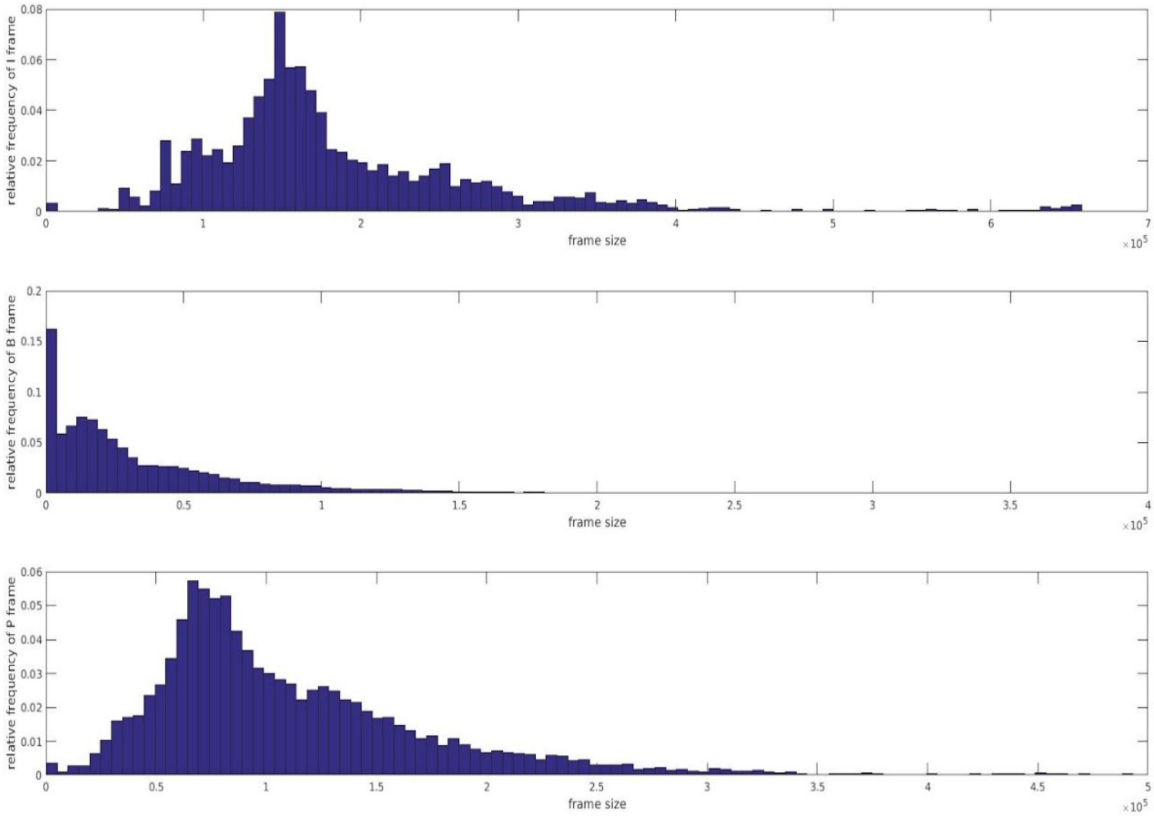
1. **Generate a graph that shows the frame size as a function of the frame sequence number. (Use the sequence in which the frames are listed in the file,**

i.e., the transmit sequence)



The graph above is the frame size versus the frame sequence number, we could see that the frame size are pretty random.

2. **Generate a graph that shows the distribution of I frames, B frames, and P frames. (x-axis is the frame size, y-axis is the relative frequency).**

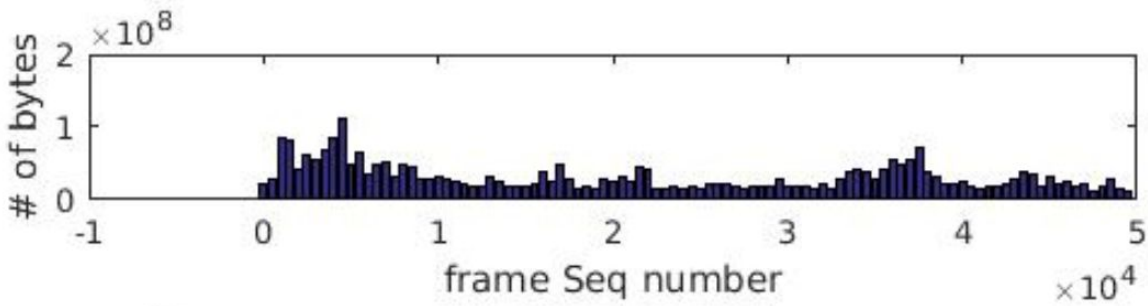


The graph above is the relative frequency of the I, B, P frames sizes. We use the hist function to distribute the size of the frames into 100 bins.

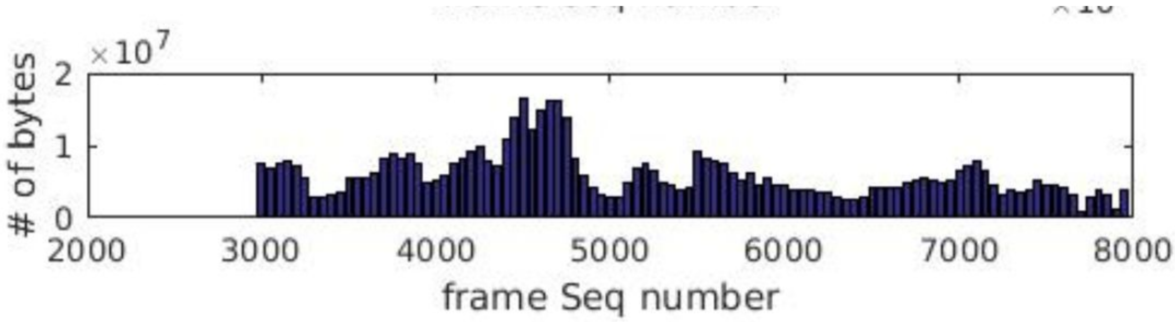
Exercise 2.3:

Create three plots of the video traffic trace viewed at different scales. Each graph has 100 data points.

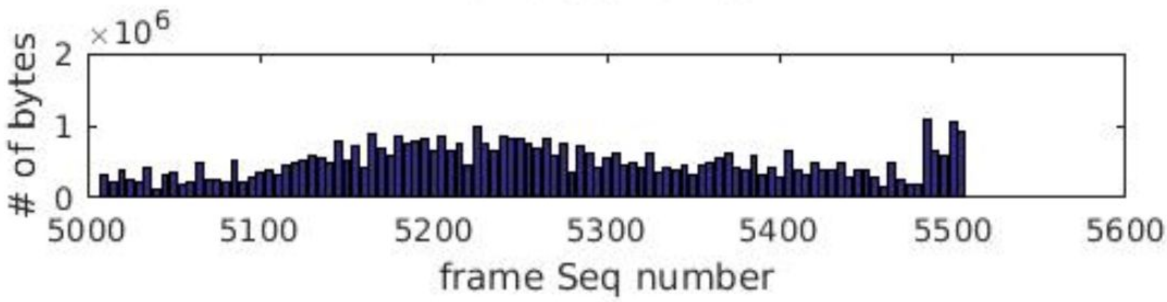
Plot 1: Generate a vector with 100 elements. Starting with Frame 1, each element stores the amount of data from 500 frames of the video sequence.



Plot 2: Generate a vector with 100 elements. Starting with a randomly selected frame, each element stores the amount of data from 50 frames of the video sequence.



Plot 3: Generate a vector with 100 elements. Starting with a randomly selected frame, each element stores the amount of data from 5 frames of the video sequence.



Describe your observations of the graphs, and compare them to the scaled versions of the Poisson plots from Part 1.

Because the video traffic depends very much on the content being displayed, for instance, a video scene with dark background may require less traffic as it is constructed mostly by B frame. Compare to the plot of part 1, the plot does not look as smooth as part 1 at large time interval, but smoother than part 1 at granular time interval.

-1: it could be better to mention that video frames are self-similar

Part 3

Exercise 3.2:

+5: working with the longer version

Analyze the trace of the Ethernet traffic:

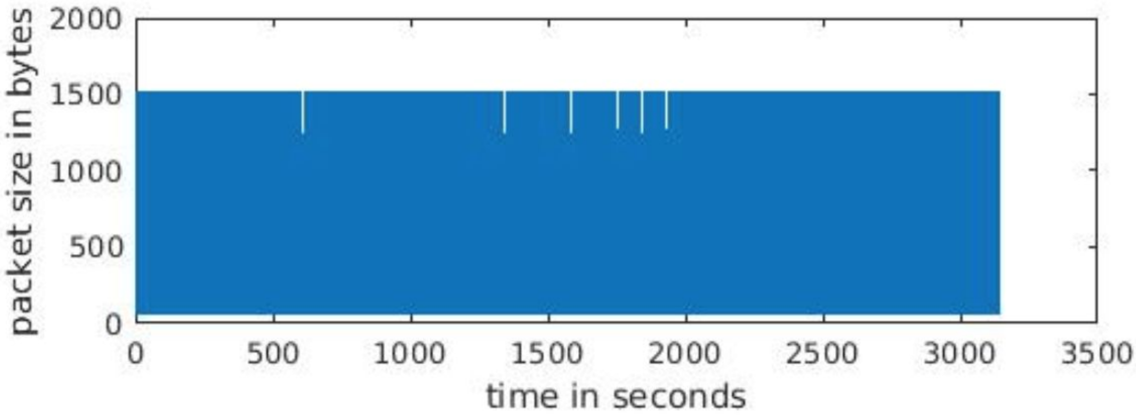
- **Compute the number of captured packets and total number of bytes;**
  - Number of captured packets = 1000000
  - Total number of bytes = 434292031 bytes
- **Compute the mean bit rate of the entire trace;**
  - Mean bit rate = 1.105483078535002 Mbps
- **Compute the peak bit rate of the trace (defined as the rate that maximizes the ratio “packet size”/”time since last packet”).**
  - Peak bit rate = 43.49999995528390e Mbps
- **Compute the ratio of the peak rate and the average rate. Compare this value to the peak-to-average rate ratio from the video trace in Part 2.**

- Ratio of the peak and the mean rate = 39.349313254917080

-1: comparison with the previous ratio is missed.

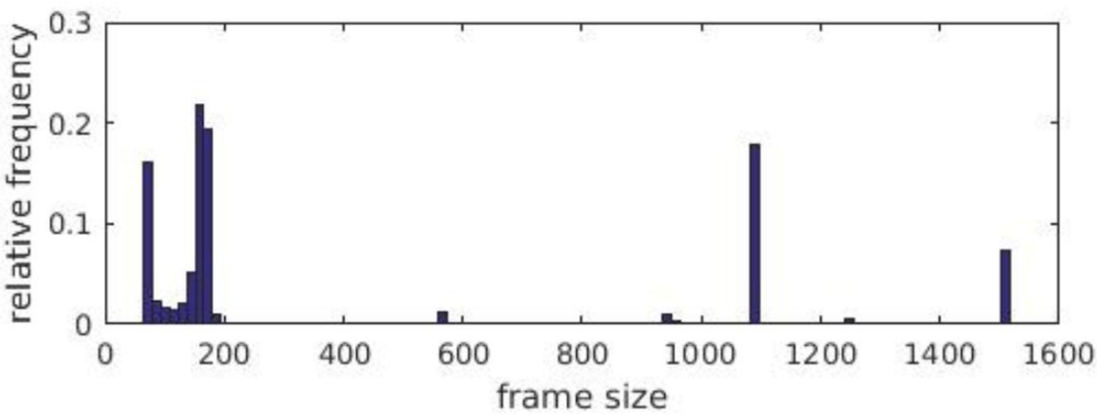
Generate a set of graphs that show properties of the Ethernet traffic trace

1. **Generate a graph that depicts the packet size as a function of time.**



We use the longer version of the file

2. **Generate a graph that shows the distribution of packet sizes (x-axis shows the packet size, y-axis shows the relative frequency).**

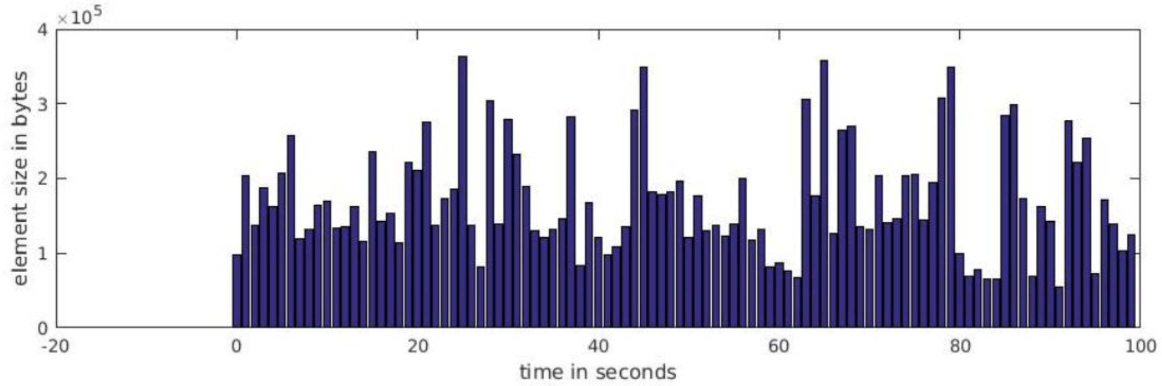


We use the hist function to distribute the size of the frames into 100 bins.

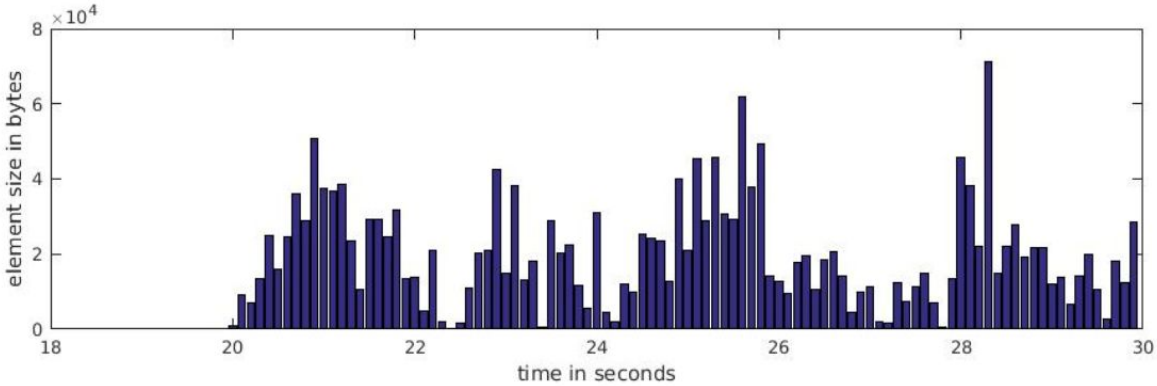
Exercise 3.3:

Continue with the 100 second excerpt of Ethernet traffic from the previous exercise. Create three plots of the Ethernet traffic trace viewed at different scales. Each graph has 100 data points.

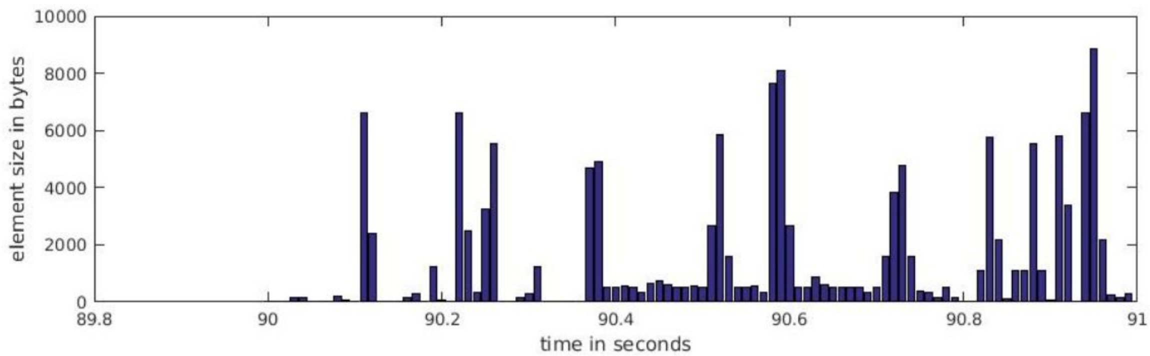
Plot 1: Generate a vector with 100 elements, where each element stores the amount of data captured in a 1 s interval.



Plot 2: Generate a vector with 100 elements, where each element stores the traffic from 100 ms worth of captured traffic. Select a random starting time.



Plot 3: Generate a vector with 100 elements, where each element stores the traffic from 10 ms worth of captured traffic. Select a random starting time.



Describe your observations of the graphs, and compare them to the plots from the Poisson traffic and the video trace.

Unlike Poisson traffic and video traffic, the graph does not look smoother when look at it in large scale. The traffic seems pretty random at any time interval. The Ethernet traffic flow could not be predicted, and it appears to have more bursties than Poisson traffic