Lab Ten (Python 2.7.12)

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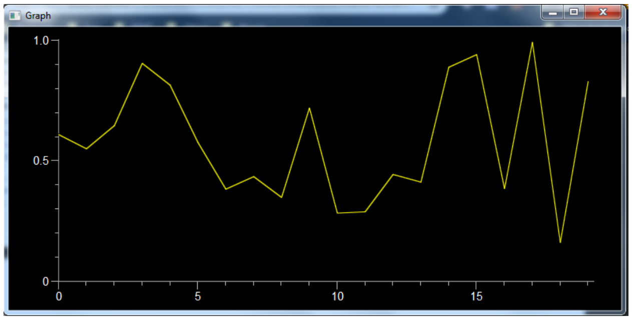
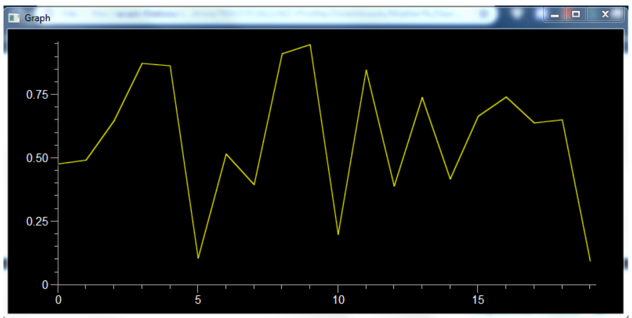
Question 28



(a) One Graphical output of Question 28



(b) One Graphical output of Question 28

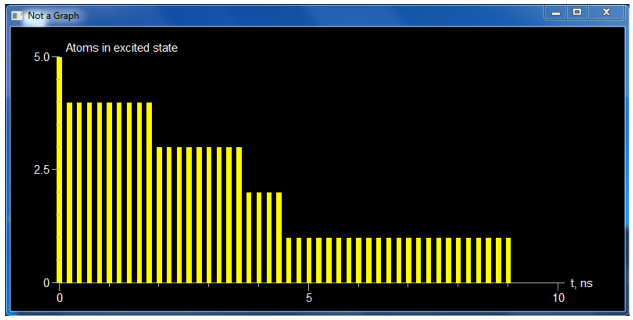
Figure 1: Outputs of Question 28

The x-axis of the plots produced correlate to time and the y-axis correlates to the the number of photons emitted.

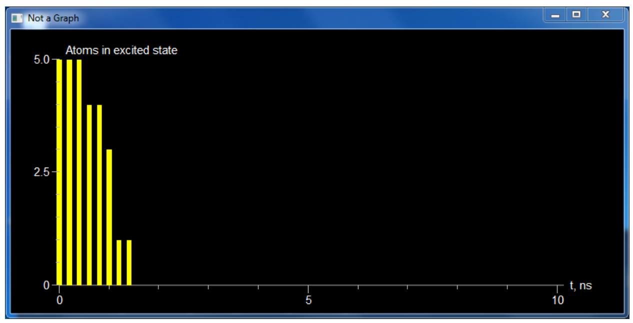
After running the program numerous times, it is apparent that each of the plots are unique.

The absolute maximum value for the random function is 1, while the absolute minimum is 0.

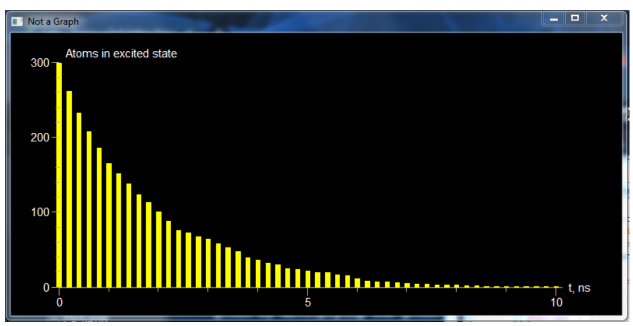
Question 29



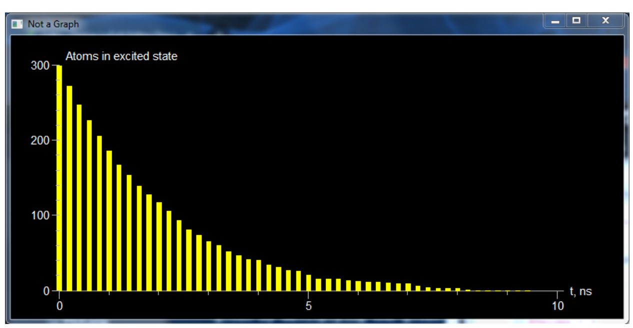
(a) Longest Time Observed



(b) Shortest Time Observed



(c) Graphical output of Part C



(d) Graphical output of Part C

Figure 2: Outputs of Question 29

The line of code that decides whether a particular atom will emit or not is line 30 in the submitted code, the conditional statement that needs the output of the random function to be less than P.

The probability that a given atom will emit a photon in one nanosecond can be found by multiplying the probability given by multiplying the given probability of 0.1 by the desired time interval to produce a probability of 0.1.

The line of code that counts the decrease in excited atoms after an atom emits a photon is given as line 35 in the submitted code. Where Natoms is equal to the difference between itself and emissions.

The longest time that was observed was 9.0 nanoseconds, while the shortest time was 1.4 nanoseconds. This can be seen in Figure 2 a and b.

It was determined that the plots look the same when the number of atoms is approximately 300. As seen in Figure 2 c and d.

There is no vertical bar that corresponds to a height of $10000/e$ or 3680. However, the there is a vertical bar that was recorded on both sides of the mean lifetime. One with a height of 3905 at 1.6 nanoseconds, and the other was 3524 at 1.8 nanoseconds. Since it is closer to the 1.8 nanosecond bar, I will use that as the comparison. The value of dt/P is 2 nanoseconds per emission. The approximate mean lifetime of 1.8 nanoseconds is close to the ideal mean lifetime of 2 nanoseconds.

Question 30

The quantity that is plotted on the x-axis corresponds to time in units of nanoseconds, and the quantity that is plotted on the y-axis corresponds to the number of photons being emitted.

Red photons have a higher probability of emission.

There is not a significant amount of variability associated with the emission of the green photons.

The experimental average associated with the emission of green photons,provided in P30.out, was calculated to be 30.1 emitted photons. The number of trials that fit within the range $30.1 \pm \sqrt{30.1}$ was 24 out of 30.