3 Auction Simulations

To complete this assignment, please write "high-quality" Python code that does the following:

1. For each of the distributions below, please:
   (a) Plot the bid function of a second-price auction, and a first-price auction with 2, 5 and 10 bidders.
   (b) Compute the expected revenue (how much money the seller receives) in both the first-price auction and the second price auction with 2, 5 and 10 bidders. Also compute the standard deviation of the seller's revenue.
   (c) Assume that the seller can choose a reserve price and has their own value for the item. Plot the optimal reserve price as a function of the value of the item to the seller. Assume that a second-price auction is held.[5] Plot this in the case of 2, 5 and 10 bidders.
2. Intuitively explain the relationship between the expected revenue in the first- and second-price auctions.
3. Describe your reserve price results and intuitively explain them.

Distributions to analyze:

i Values are distributed uniform on the range [0,1].

ii Values are distributed uniform on the range [5,10].

iii Values are distributed as a triangle distribution on [0,1] with a mid-point of $\frac{1}{2}$.

iv Values are exponential ($\lambda = 1$).

Please turn in the following:

1. A write up which describes how you answered the questions. In particular, please explain what you simulated, (as opposed to analytically calculated), any aberrations you noticed, graphics that do not make sense or other issues. In terms of length, the written portion (ignoring graphics) will be around one full page.
2. The code which generates your results. The code will be run from the command line and standard libraries are allowed.

[5] For example, the seller may value the item at .5. If the reserve price is .6 and no one bids above the reserve price, the seller keeps the item. If the seller has no reserve price and sells the item for below .5 then the seller loses money.