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1. Consider the following algorithm (done in class) to sample from a distribution :

   (i) Generate a uniform $U \sim \mathcal{U}[0,1]$.

   (ii) Find $K \in \{1, 2, \ldots, n\}$ such that $q_{K-1} < U \leq q_K$.

   (iii) Set $X = c_K$.

   (a) Use the above algorithm to generate exponential variates.

   (b) Using the same algorithm to generate discrete uniform variates on $\{1, 3, 5, 7, 9\}$.

2. Use the acceptance-rejection method to generate samples from a distribution with density function:

$$f(x) = 20x(1-x)^3.$$

   (a) Take $\mathcal{U}[0,1]$ as the known density function g. You have to first find out the smallest constant c that satisfies the required inequality ($f(x) \leq cg(x)$).

   (b) Then, with the smallest such constant c, generate a random sample from f. Check if these values convergence. Also, keep a count of number of iterations needed to find one variate.

   (c) Finally, compute the average of all these values, and see how it compares with the value of c that you have chosen.

   (d) Now, repeat the above experiment with two values of c higher than the smallest value that you have chosen. What are your observations ?

3. Consider the problem of generating a discrete random variable X that takes one of the values $1, 2, \ldots, 10$ with corresponding probabilities $0.11, 0.12, 0.09, 0.08, 0.12, 0.10, 0.09, 0.09, 0.10, 0.10$. Using the discrete uniform distribution on $1, 2, \ldots, 10$ as the base (i.e., in place of g), generate a random sample from X, again with two possible values of the constant c. What is your conclusion ?