

Coding Exercise 3

1. Rewrite the code *game_reshape.txt* (uploaded in hello iitk portal) by replacing the *numpy.reshape* commands into a user-defined subroutine. In other words, you need to write a user-defined function that implements *numpy.reshape*, and test it on the given code.
2. Let x be given by the quantity below. Write a code to compute an approximation of x using recursion.

$$x = \sqrt{6 + \sqrt{6 + \sqrt{6 + \sqrt{6 + \cdots}}}}$$

3. Write a code to compute $\binom{n}{r}$ using recursion. Do this without computing the factorial of any number.
4. (a) Let X be a discrete random variable whose pmf is given by $P_X(X = i) = \frac{i}{10}$, $i = 1, 2, 3, 4$. Generate $X_1, X_2, \dots, X_{1000}$ i.i.d. $\sim P_X$ using *randint* command. Verify if the generated values are according to P_X using histogram.
 (b) Let $P_X(X = i) = \frac{\sqrt{i}}{\sum_{j=1}^4 \sqrt{j}}$. Repeat what you did in part (a) using *rand* command. Can you generate the random values using *randint* command?
5. Generate $X_1, X_2, \dots, X_{1000}$ i.i.d. $\sim f_X$, and verify using a histogram, if

$$f_X(x) = \begin{cases} 1+x & \text{if } x \in [-1, 0], \\ 1-x & \text{if } x \in [0, 1]. \end{cases}$$

6. Generate $X_1, X_2, \dots, X_{1000}$ i.i.d. $\sim f_X$, if $f_X(x) = xe^{-x}$ when $x > 0$. Verify using a histogram. Note that the inverse of the cdf of this distribution cannot be expressed in closed form; so generate two exponential random variables and add them to generate one data point X_i .