A   Rolling two dices

In a random experiment, two dice are rolled. The result of the experiment, i.e., the random variable, corresponds to the sum of the numbers on the dice.

1. **(5)** What are the elementary events of this experiment

2. **(25)** Simulate in MATLAB that you performed the experiment 10 times. Plot the absolute and relative frequencies of the elementary events. Do the same for 1000 realizations of the experiment and integrate the result in the plot.
   Hint: use the function `randi`.

3. **(5)** Give the probability for the elementary event.

4. **(5)** Give the probability for any event which is a subset of the set of the elementary events.

B   Probability density function

5. **(30)** Check which of the following functions is a probability density function and explain why.
   a)
   $$f(x) = \begin{cases} 5/2x - x^2 & x \in [0,1] \\ 0 & \text{otherwise} \end{cases}$$

   b)
   $$f(x) = \begin{cases} x - 2x^2 & x \in [0,1] \\ 0 & \text{otherwise} \end{cases}$$

   c)
   $$f(x) = \begin{cases} 2/(x^2) & x \in [1,2] \\ 0 & \text{otherwise} \end{cases}$$

6. **(20)** Compute the cumulative density function and the expectation value of
   $$f(x) = \begin{cases} 1 & 0 < x < 1 \\ 0 & \text{otherwise} \end{cases}$$

7. **(10)** You have a random variable $\underline{x}$ that is Normal distributed with $\underline{x} \sim \mathcal{N}(\mu = 120, \sigma^2 = 16)$. Compute the expectation values of the random variables $\underline{y}_1, \ldots, \underline{y}_4$.

   - $\underline{y}_1 = \underline{x} - 15$
   - $\underline{y}_2 = (\underline{x}/3) - 12 + \underline{y}_1$

Total: 100