For each problem, explain/justify how you obtained your answer in order to obtain full credit. In fact, most of the credit for each problem will be given for the derivation/model used as opposed to the final answer.

**Question 1.** Consider an experiment where we roll two 6-sided dice. Let random variable $Y$ be the sum of the values rolled. The sample space is $\{(1, 1), (1, 2), (1, 3), \ldots, (6, 6)\}$ and recall that a random event is a subset of the sample space.

(a) What random event corresponds to $Y = 2$ ?
(b) What event corresponds to $Y = 3$ ?
(c) What event corresponds to $Y = 4$ ?
(d) Now let $X$ be the indicator random variable associated with the event $\{(1, 1), (2, 2), (3, 3)\}$. What is the probabilities that $X = 1$ ?

**Question 2.** Let $X$ represent the difference between the number of heads and the number of tails obtained when a coin is tossed 3 times.

(a) What are the possible values of $X$ ?
(b) What is $P(X = -3)$ ?
(c) What is $P(X = -1)$ ?
(d) If the coin is assumed fair, calculate the PMF and CDF of $X$ and plot a sketch of both.

**Question 3.** Four 6-sided dice are rolled. The dice are fair, so each one has equal probability of producing a value in $\{1, 2, 3, 4, 5, 6\}$. Let $X$ = the minimum of the four values rolled. (It is fine if more than one of the dice has the minimal value.)

(a) What is $P(X \geq 1)$ ?
(b) What is $P(X \geq 2)$ ?
(b) What is the CDF of $X$ i.e. $P(X \geq k)$ for all values of $k$ ?