

(a) i. The probability that the spider move to other squares is equal. Thus

$$P(C1 \rightarrow C2) = P(C1 \rightarrow C5) = \frac{1}{2}.$$

$$\text{ii. } P(C2 \rightarrow C1) = P(C2 \rightarrow C3) = P(C2 \rightarrow C6) = \frac{1}{3}.$$

$$\text{iii. } P(C6 \rightarrow C2) = P(C6 \rightarrow C5) = P(C6 \rightarrow C7) = P(C6 \rightarrow C10) = \frac{1}{4}.$$

(b) Yes, since the spider can move to any of the available adjacent squares vertically up or down or horizontally left or right.

(c) Yes. The length of every path starting and ending at the same square must be divisible by 2, in other words, every loop must have even length. If we regard the loop as two paths with equal length, one is consisted of only left and downward movement, and one is consisted of only right and upward movement, we will find out that the length of the two paths must be same no matter how the origin loop is, since the starting square and the ending square must be the same, and the number of downward movements must be the same as the number of upward movements, the number of right movements must be the same as the number of left movements. Thus, the length of a loop must be even.