AI1110
Assignment 6

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Outline

Exercise 6.40

The random variables x and y are of discrete type,independent with $P\{x = n\} = a_n$, $P\{y = n\} = b_n$,n=0,1,.....Show that, if $z = x + y$, then $P\{z = n\} = \sum_{k=0}^{n} a_n b_{n-k}$

Solution

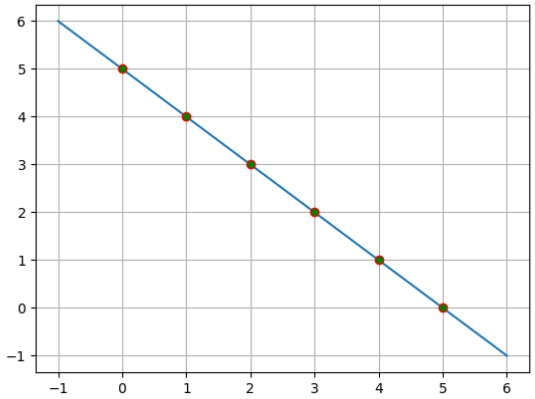

Figure 1: if n =5

Since x and y are independent,

$$P\{x = k, y = n - k\} = P\{x = k\}P\{y = n - k\} \quad (1)$$

$$= a_n b_{n-k} \quad (2)$$

Answer

Since $z = x + y$;

$$\{z = n\} = \sum_{k=0}^{n} \{x = k, y = n - k\} \tag{3}$$

$$\implies P\{z = n\} = \sum_{k=0}^{n} P\{x = k, y = n - k\} \tag{4}$$

$$\implies P\{z = n\} = \sum_{k=0}^{n} a_n b_{n-k} \tag{5}$$