Cambridge International AS & A Level

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Mathematics 9709/52

Paper 5 Probability & Statistics 1 **May/June 2022**

Question No (2)

2 A fair 6-sided die has the numbers 1, 2, 2, 3, 3, 3 on its faces. The die is rolled twice. The random variable X denotes the sum of the two numbers obtained.

(a) Draw up the probability distribution table for X.

(b) Find $\mathrm{E}(X)$ and $\mathrm{Var}(X)$.

Solution:

(a)

+	1	2	2	3	3	3
1	1+1=2	1+2=3	3	4	4	4
2	2+1=3	2+2=4	2+2=4	2+3=5	2+3=5	2+3=5
2	3	4	4	5	5	5
3	4	5	5	6	6	6
3	4	5	5	6	6	6
3	4	5	5	6	6	6

x	2	3	4	5	6
$P(X=x)$	$\frac{1}{36}$	$\frac{4}{36}$	$\frac{10}{36}$	$\frac{12}{36}$	$\frac{9}{36}$

(b)

$$E(X) = \sum_{i=1}^{n} x_i p_i$$

$$= x_1 p_1 + x_2 p_2 + x_3 p_3 + \cdots + x_n p_n$$

$$= 2(1/36) + 3(4/36) + 4(\tfrac{10}{36}) + 5(\tfrac{12}{36}) + 6(9/36)$$

$$= \frac{2}{16} + \frac{12}{16} + \frac{40}{36} + \frac{60}{36} + \frac{54}{36}$$

$$= \frac{168}{36}$$

$$= \frac{14}{3}$$

$$E(X) = 4.67$$

$$Var(X) = \sum_{i=1}^{4} x_i^2 p_i - [E(X)]^2$$

$$= (2)^2\left(\frac{1}{36}\right) + (3)^2\left(\frac{4}{36}\right) + (4)^2\left(\frac{10}{36}\right) + (5)^2\left(\frac{12}{36}\right) + (6)^2\left(\frac{9}{36}\right) - \left(\frac{14}{3}\right)^2$$

$$= \frac{4}{36} + \frac{36}{36} + \frac{160}{36} + \frac{360}{36} + \frac{324}{36} - \left(\frac{14}{3}\right)^2$$

$$= \frac{4+36+160+360+324}{36} - \frac{196}{9}$$

$$= \frac{82.4}{36} - 21.77$$

$$= 22.888 - 21.77$$

$$Var(X) = 1.11$$