Random variables and probability tables

6 questions | 13 marks

Equivalent correct methods earn the corresponding marks.

1. Let X count the number of goals in a match. Explain why X is discrete. [1 mark]

Goals are counted in whole numbers.

The possible values can be listed.

Answer: Its possible values are 0, 1, 2, … .

2. X takes values 0, 2 and 5 with probabilities 0.2, 0.5 and p. Find p. [2 marks]

Add the known probabilities: 0.2 + 0.5 = 0.7.

Use total probability 1: p = 1 − 0.7 = 0.3.

Answer: p = 0.3.

3. For values −1, 0 and 1, probabilities are $k, 4k, 3k$. Find k and the probability of a positive value. [3 marks]

$8k = 1$, so $k = 1/8$.

Only the value 1 is positive, giving probability 3k.

Answer: $k = 1/8$; $P(X > 0) = 3/8$.

4. A proposed table uses probabilities 0.4, −0.1 and 0.7. Is it valid? Explain. [2 marks]

The entries do sum to 1.

That is insufficient: every individual probability must be at least zero.

Answer: No. A probability is negative.

5. A bag contains three red and one blue counter. One is selected fairly. Define X = 1 for red and X = 0 for blue. Give its distribution. [2 marks]

There are four equally likely counters.

Group the three red outcomes at X = 1 and the one blue outcome at X = 0.

Answer: $P(X = 0) = 1/4,\ P(X = 1) = 3/4$.

6. Two fair independent coin tosses are made. Let Y be the number of tails. Give all values and probabilities. [3 marks]

List HH, HT, TH and TT.

The tail counts are 0, 1, 1 and 2; group equal counts.

Answer: $y = 0, 1, 2$ with probabilities $1/4, 1/2, 1/4$.