

## LC 2014: PAPER 2

### QUESTION 3 (25 MARKS)

#### Question 3 (a)

Number of arrangements of  $n$  objects,  $p$  alike of one kind,  $q$  alike of another kind =  $\frac{n!}{p!q!}$

In order to win €8 playing Game  $A$  four times, John would have hit the following segments: €0, €0, €3 and €5, but not necessarily in that order.

How many arrangements can be made of 4 objects, 2 of which are alike?

Number of ways John could win €8 =  $\frac{4!}{2!} = \frac{4 \times 3 \times 2 \times 1}{2 \times 1} = 12$

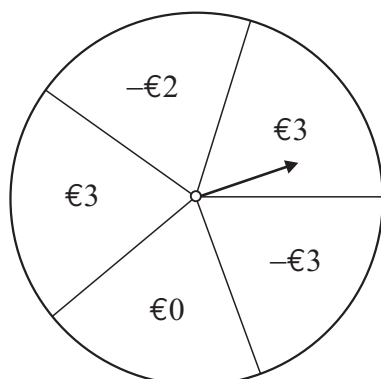
#### MARKING SCHEME NOTES

##### Question 3 (a) [Scale 10C (0, 3, 7, 10)]

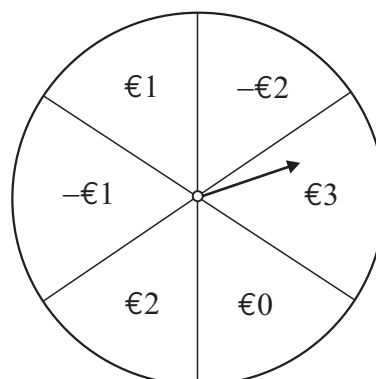
- 3: • Some reference to €3 and €5  
7: • Listing with not more than five omitted

#### Question 3 (b)

The spinners are redrawn and the values represent the amount the charity would gain for each spin.



Game  $A$



Game  $B$

Calculate the expected earnings  $E(x)$  for each €3 bet placed.

Game  $A$ :  $E(x) = \frac{1}{5}(3) - \frac{1}{5}(2) + \frac{1}{5}(3) + \frac{1}{5}(0) - \frac{1}{5}(3) = \frac{1}{5} = \text{€}0.20$

Game  $B$ :  $E(x) = \frac{1}{6}(3) - \frac{1}{6}(2) + \frac{1}{6}(1) - \frac{1}{6}(1) + \frac{1}{6}(2) + \frac{1}{6}(0) = \frac{3}{6} = \text{€}0.50$

#### EXPECTED VALUE $E(x)$

$$E(x) = \sum xP(x)$$

Game  $B$  would be more successful at earning money for the charity as its expected earnings are higher per spin.

#### MARKING SCHEME NOTES

##### Question 3 (b) [Scale 5C (0, 2, 3, 5)]

- 2: • One partially accurate statement  
• Expected outcome formula  
3: • Correct answer but inaccurate/only partially correct supporting evidence  
• Expected outcome of both Game  $A$  and Game  $B$  calculated but incorrect or no conclusion.

**Question 3 (c)**

$$p = P(4) = \frac{1}{6}, q = P(\text{Not } 4) = \frac{5}{6}$$

$$n = 6, r = 2, p = \frac{1}{6}, q = \frac{5}{6}$$

$$P(2 \text{ successes}) = {}^6C_2 \left(\frac{1}{6}\right)^2 \left(\frac{5}{6}\right)^4 = \frac{3125}{15552} = 0.2$$

**BERNOULLI TRIALS**

$$P(r \text{ successes}) = {}^nC_r p^r q^{n-r}$$

**MARKING SCHEME NOTES****Question 3 (c) [Scale 10C (0, 3, 7, 10)]**

- 3:**
- Establishes probability of stopping on €4 sector once
  - Establishes probability of not stopping on €4 sector once
  - Effort to express a relevant binomial expansion
- 7:**
- Omits  $\binom{6}{2}$
  - Indices incorrectly assigned