2.7 Statistics: Probability Depth: 1-hour Pack

EDEXCEL 9MA0 · Calculator allowed · about 60 minutes

Total Marks

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

A-Level Statistics: Probability Depth Practice

Original material written for Revision Library, styled on Edexcel AS/A-level Mathematics (9MA0) Statistics content.

This pack extends core probability skills to full A-level depth: Venn diagrams and set notation for two and three events, tree diagrams for dependent and independent trials, conditional probability, testing and proving independence algebraically, and probability models involving an unknown to be found from a given equation, including quadratics arising from probability statements. All contexts and figures are original.

1 A bag contains 9 counters: 5 red and 4 blue. Two counters are drawn at random from the bag, one after another, without replacement.

(a) Find the probability that both counters drawn are red. **(2)**

(b) Find the probability that exactly one of the two counters drawn is red. **(3)**

(c) Given that the first counter drawn is blue, find the probability that the second counter drawn is red. **(2)**

(Total for Question 1 is 7 marks)

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2 A bag contains 6 red counters and 8 blue counters. Two counters are taken at random from the bag, one after the other, without replacement.

(a) Draw a tree diagram, labelling each branch with its probability, and state the probability that both counters are red. **(4)**

(b) Find the probability that the two counters are the same colour. **(2)**

(c) Given that the two counters are different colours, find the probability that the first counter was red. **(2)**

(Total for Question 2 is 8 marks)

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3 119 club members were asked which of three sports they prefer, and whether they are left-handed or right-handed. The results are:
Sport: Swimming, Tennis, Golf
Left-handed: 5, 19, 10
Right-handed: 37, 20, 28

(a) A member is chosen at random. Find the probability that the member prefers tennis. **(2)**

(b) Given that the member prefers tennis, find the probability that the member is left-handed. **(2)**

(c) Given that the member is left-handed, find the probability that the member prefers swimming. **(2)**

(Total for Question 3 is 6 marks)

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4 The events A and B are independent, with P(A) = 1/3 and P(B) = 2/7.

(a) Find P(A and B) and P(A or B). **(4)**

(b) The independent events C and D satisfy P(D) = 2/7 and P(C or D) = 11/21. Find P(C). **(3)**

(c) Find P(A | B') and state what this shows about A and B. **(3)**

(Total for Question 4 is 10 marks)

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5 A bag contains 5 red counters and 5 blue counters. Two counters are taken at random from the bag, one after the other, without replacement.

(a) Draw a tree diagram, labelling each branch with its probability, and state the probability that both counters are red. **(4)**

(b) Find the probability that the two counters are the same colour. **(2)**

(c) Given that the two counters are different colours, find the probability that the first counter was red. **(2)**

(Total for Question 5 is 8 marks)

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6 A machine in a factory produces electronic components. Each component produced is faulty, independently of all other components, with probability 0.04. A random sample of 3 components is checked.

(a) Find the probability that exactly one of the three components is faulty. **(3)**

(b) Find the probability that at least one of the three components is faulty. **(3)**

(c) State the probability that none of the three components is faulty. **(1)**

(d) Given that at least one of the three components is faulty, find the probability that exactly one of the three components is faulty. **(2)**

(Total for Question 6 is 9 marks)

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Mark scheme · 2.7 Statistics: Probability Depth: 1-hour Pack

Question 1

(a) (5/9) x (4/8), oe	**M1**
(a) cao 5/18 (awrt 0.278)	**A1**
(a) Answer: P(both red) = 5/18 (awrt 0.278)	
(b) P(red then blue) = (5/9) x (4/8), oe	**M1**
(b) P(blue then red) = (4/9) x (5/8), oe, and adding the two paths	**M1**
(b) cao 5/9 (awrt 0.556)	**A1**
(b) Answer: P(exactly one red) = 5/9 (awrt 0.556)	
(c) identify the remaining counters after one blue is removed: 5 red and 3 blue (8 left)	**M1**
(c) cao 5/8 (= 0.625)	**A1**
(c) Answer: P(second red | first blue) = 5/8 (= 0.625)	

Question 2

(a) first branches 3/7 (red) and 4/7 (blue)	**B1**
(a) second branches 5/13, 8/13 after red; 6/13, 7/13 after blue	**B1**
(a) P(RR) = 3/7 x 5/13	**M1**
(a) 15/91	**A1**
(a) Answer: 15/91	
(b) P(RR) + P(BB)	**M1**
(b) 43/91	**A1**
(b) Answer: 43/91	
(c) conditional probability: P(RB)/P(different)	**M1**
(c) 1/2	**A1**
(c) Answer: 1/2	

Question 3

(a) tennis total = 19 + 20	**M1**
(a) 39/119 = 39/119	**A1**
(a) Answer: 39/119	
(b) conditional probability: left-handed tennis players / all tennis players	**M1**
(b) 19/39 = 19/39	**A1**
(b) Answer: 19/39	
(c) left-handed swimmers / all left-handed members	**M1**
(c) 5/34 = 5/34	**A1**
(c) Answer: 5/34	

Question 4

(a) independent so P(A and B) = P(A) x P(B)	**M1**
(a) 2/21	**A1**
(a) P(A or B) = P(A) + P(B) - P(A and B)	**M1**
(a) 11/21	**A1**
(a) Answer: P(A and B) = 2/21, P(A or B) = 11/21	
(b) forms p + 2/7 - 2/7p = 11/21	**M1**
(b) rearranges: p(1 - 2/7) = 5/21	**M1**
(b) P(C) = 1/3	**A1**
(b) Answer: P(C) = 1/3	
(c) P(A | B') = P(A and B')/P(B') = P(A)P(B')/P(B')	**M1**
(c) 1/3	**A1**
(c) it equals P(A), confirming that A and B are independent	**B1**
(c) Answer: 1/3	

Question 5

(a) first branches 1/2 (red) and 1/2 (blue)	**B1**
(a) second branches 4/9, 5/9 after red; 5/9, 4/9 after blue	**B1**
(a) P(RR) = 1/2 x 4/9	**M1**
(a) 2/9	**A1**
(a) Answer: 2/9	
(b) P(RR) + P(BB)	**M1**
(b) 4/9	**A1**
(b) Answer: 4/9	
(c) conditional probability: P(RB)/P(different)	**M1**
(c) 1/2	**A1**
(c) Answer: 1/2	

Question 6

(a) identify 3 ways of choosing which component is faulty, e.g. 3 x 0.04 x 0.96^2	**M1**
(a) correct substitution: 3 x 0.04 x 0.9216	**M1**
(a) awrt 0.111	**A1**
(a) Answer: P(exactly one faulty) = 0.111 (3 s.f.)	
(b) P(none faulty) = 0.96^3	**M1**
(b) 1 - P(none faulty)	**M1**
(b) awrt 0.115	**A1**
(b) Answer: P(at least one faulty) = 0.115 (3 s.f.)	
(c) cao awrt 0.885, following through from part (b) as 1 - their answer	**B1ft**
(c) Answer: P(none faulty) = 0.885 (3 s.f.)	
(d) their (a) / their (b), using the fact that 'exactly one' implies 'at least one'	**M1ft**
(d) awrt 0.959	**A1**
(d) Answer: P(exactly one | at least one) = awrt 0.959	

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