2.3 Statistics: Probability: 1-hour Pack

EDEXCEL 9MA0 · Calculator allowed · about 60 minutes

Total Marks

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 In a survey of 100 students, 33 study French (F) and 41 study Spanish (S). 15 students study both languages.

(a) Complete the Venn diagram by finding the number of students in each region (F only, S only, both, neither). **(3)**

(b) A student is chosen at random. Find the probability that the student studies at least one of the languages. **(2)**

(c) Given that a randomly chosen student studies Spanish, find the probability that the student also studies French. **(2)**

(d) Determine whether studying French and studying Spanish are statistically independent events. **(2)**

(Total for Question 1 is 9 marks)

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2 A bag contains 6 red counters and 6 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 In a survey of 40 students, 10 study French (F) and 13 study Spanish (S). 6 students study both languages.

(a) Complete the Venn diagram by finding the number of students in each region (F only, S only, both, neither). **(3)**

(b) A student is chosen at random. Find the probability that the student studies at least one of the languages. **(2)**

(c) Given that a randomly chosen student studies Spanish, find the probability that the student also studies French. **(2)**

(d) Determine whether studying French and studying Spanish are statistically independent events. **(2)**

(Total for Question 3 is 9 marks)

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4 A bag contains 6 red counters and 7 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 4 is 8 marks)

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5 The random variable $X \sim B(10, 0.3)$.

(a) Calculate $P(X = 3)$, giving your answer to 3 significant figures. **(2)**

(b) Calculate $P(X \leq 2)$. **(3)**

(c) Calculate $P(X \geq 4)$. **(3)**

(Total for Question 5 is 8 marks)

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6 The discrete random variable X has probability distribution given by $P(X = x) = kx$ for $x = 1, 2, 3, 4$, and $P(X = x) = 0$ otherwise, where k is a constant.

(a) Show that $k = 0.1$. **(2)**

(b) Find $P(X \geq 3)$. **(2)**

(c) Find $E(X)$. **(3)**

(d) Find $Var(X)$. **(4)**

(Total for Question 6 is 11 marks)

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Mark scheme · 2.3 Statistics: Probability: 1-hour Pack

Question 1

(a) F only = 33 - 15	**M1**
(a) F only 18, S only 26, both 15	**A1**
(a) neither = 100 - 18 - 26 - 15 = 41	**A1**
(a) Answer: F only 18, S only 26, both 15, neither 41	
(b) P(F union S) = P(F) + P(S) - P(F and S)	**M1**
(b) 59/100	**A1**
(b) Answer: 59/100	
(c) P(F | S) = P(F and S)/P(S)	**M1**
(c) 15/41	**A1**
(c) Answer: 15/41	
(d) compares P(F) x P(S) = 1353/10000 with P(F and S) = 3/20	**M1**
(d) not independent	**A1**
(d) Answer: not independent	

Question 2

(a) first branches 1/2 (red) and 1/2 (blue)	**B1**
(a) second branches 5/11, 6/11 after red; 6/11, 5/11 after blue	**B1**
(a) P(RR) = 1/2 x 5/11	**M1**
(a) 5/22	**A1**
(a) Answer: 5/22	
(b) P(RR) + P(BB)	**M1**
(b) 5/11	**A1**
(b) Answer: 5/11	
(c) conditional probability: P(RB)/P(different)	**M1**
(c) 1/2	**A1**
(c) Answer: 1/2	

Question 3

(a) F only = 10 - 6	**M1**
(a) F only 4, S only 7, both 6	**A1**
(a) neither = 40 - 4 - 7 - 6 = 23	**A1**
(a) Answer: F only 4, S only 7, both 6, neither 23	
(b) P(F union S) = P(F) + P(S) - P(F and S)	**M1**
(b) 17/40	**A1**
(b) Answer: 17/40	
(c) P(F | S) = P(F and S)/P(S)	**M1**
(c) 6/13	**A1**
(c) Answer: 6/13	
(d) compares P(F) x P(S) = 13/160 with P(F and S) = 3/20	**M1**
(d) not independent	**A1**
(d) Answer: not independent	

Question 4

(a) first branches 6/13 (red) and 7/13 (blue)	**B1**
(a) second branches 5/12, 7/12 after red; 1/2, 1/2 after blue	**B1**
(a) P(RR) = 6/13 x 5/12	**M1**
(a) 5/26	**A1**
(a) Answer: 5/26	
(b) P(RR) + P(BB)	**M1**
(b) 6/13	**A1**
(b) Answer: 6/13	
(c) conditional probability: P(RB)/P(different)	**M1**
(c) 1/2	**A1**
(c) Answer: 1/2	

Question 5

(a) 10C3 x 0.3^3 x 0.7^7	**M1**
(a) awrt 0.267	**A1**
(a) Answer: P(X = 3) = 0.267 (3 s.f.)	
(b) P(X=0) + P(X=1) + P(X=2)	**M1**
(b) correct individual terms: 0.7^{10} + 10x0.3x0.7^9 + 45x0.3^2x0.7^8	**M1**
(b) awrt 0.383	**A1**
(b) Answer: P(X ≤ 2) = 0.383 (3 s.f.)	
(c) 1 - P(X ≤ 3)	**M1**
(c) P(X ≤ 3) = P(X ≤ 2) (ft from b) + P(X = 3) (ft from a)	**M1**
(c) awrt 0.350	**A1**
(c) Answer: P(X ≥ 4) = 0.350 (3 s.f.)	

Question 6

(a) sum of probabilities = 1: k(1+2+3+4) = 1, i.e. 10k = 1	**M1**
(a) cso: k = 0.1	**A1**
(a) Answer: k = 0.1	
(b) P(X=3) + P(X=4) = 3k + 4k, using k = 0.1 (ft)	**M1**
(b) cao 0.7	**A1**
(b) Answer: P(X ≥ 3) = 0.7	
(c) sum of x P(x) with at least three correct terms	**M1**
(c) all four terms correct: 1(0.1)+2(0.2)+3(0.3)+4(0.4)	**M1**
(c) cao 3.0	**A1**
(c) Answer: E(X) = 3.0	
(d) attempt $E(X^2)$ = sum x^2 P(x)	**M1**
(d) correct value $E(X^2)$ = 10.0	**M1**
(d) Var(X) = $E(X^2)$ - $[E(X)]^2$, following through from c	**M1ft**
(d) cao 1.0	**A1**
(d) Answer: Var(X) = 1.0	

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