4.1 Permutations and Combinations: Bridge and Extension: 30-minute Pack

Total Marks

Calculator allowed · about 30 minutes

Name: _____ Date: ____ / ____ / _____

This is extension material beyond standalone Edexcel 9MA0 requirements. The narrower links are binomial coefficients, binomial expansion and binomial distributions. Answer all 20 questions and show your counting method. Give exact answers; equivalent exact forms are accepted. nPr counts ordered selections and nCr counts unordered selections, without replacement. Use each question's stated assumptions.

1 Three people are selected without replacement from seven distinct people including Isha and Leon. Order does not matter. Isha and Leon must either both be selected or both be absent. How many selections satisfy this condition?

(Total for Question 1 is 3 marks)

2 In expanding $(2 + x)^6$, the six bracket positions are distinguishable. Explain how choosing the positions that supply x gives the coefficient of x^3, and find that coefficient.

(Total for Question 2 is 3 marks)

3 A bag contains 5 individually labelled red balls and 3 individually labelled blue balls. Three balls are drawn uniformly without replacement. Each unordered set of three labelled balls is equally likely; draw order is ignored. Find the probability of exactly two red balls.

(Total for Question 3 is 3 marks)

4 A string is selected uniformly from all distinct arrangements of BALLOON, using every letter once. Identical Ls and identical Os are not individually labelled. Given that the two Os are adjacent, find the probability that the two Ls are also adjacent.

(Total for Question 4 is 4 marks)

5 A badge has one of 3 distinct shapes and one of 4 distinct colours. Every shape can have every colour. How many different badges are possible?

(Total for Question 5 is 2 marks)

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6 A four-digit integer is selected uniformly from those formed using {0, 1, 2, 3, 4, 5}, without repeating a digit and with no leading zero. Given that the integer is even, find the probability that it exceeds 3000. Justify the counts in both numerator and denominator.

(Total for Question 6 is 5 marks)

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7 A code is an ordered string of 3 digits from {0, 1, 2, 3}. Digits may repeat, and a leading zero is allowed. How many codes are possible?

(Total for Question 7 is 2 marks)

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8 How many three-digit integers can be formed from {0, 1, 2, 3, 4}, without repeating a digit? A leading zero is not allowed.

(Total for Question 8 is 3 marks)

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Mark scheme · 4.1 Permutations and Combinations: Bridge and Extension: 30-minute Pack

Question 1

Count both present as 5C1.	**M1**
Count both absent as 5C3 and add the disjoint cases.	**M1**
15 selections; accept 5C1 + 5C3.	**A1**

Answer: 15

Question 2

Choose 3 of the 6 positions, giving 6C3.	**M1**
Multiply by 2^3 from the remaining positions.	**M1**
Coefficient 160; accept 6C3 x 2^3 with the positional explanation.	**A1**

Answer: 6C3 x 2^3 = 160

Question 3

Use denominator 8C3 = 56.	**M1**
Count favourable sets as 5C2 x 3C1 = 30.	**M1**
15/28; accept (5C2 x 3C1)/8C3 or any equivalent exact form.	**A1**

Answer: 15/28

Question 4

Count strings with OO adjacent as 6!/2! = 360.	**M1**
Count strings with both pairs adjacent as 5! = 120.	**M1**
Divide the joint count by the conditioned count.	**M1**
1/3; accept 5!/(6!/2!) or any equivalent exact form.	**A1**

Answer: 1/3

Question 5

Multiply 3 by 4.	**M1**
12 badges.	**A1**

Answer: 12

Question 6

Split the even denominator by last digit zero or non-zero.	**M1**
Denominator 60 + 96 = 156.	**A1**
Split the numerator by first digit 3 or 5 versus 4.	**M1**
Numerator 72 + 24 = 96.	**A1**
8/13; accept 96/156 or any equivalent exact form.	**A1**

Answer: 8/13

Question 7

Use 4 choices independently for each position.	**M1**
4^3 = 64; accept equivalent exact forms.	**A1**

Answer: 64

Question 8

Use 4 choices for the first digit.	**M1**
Use 4 then 3 choices for the next digits.	**M1**
48 integers; accept 4 x 4 x 3.	**A1**

Answer: 48

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