

## **GCE A level Mathematics (8MA0) – Shadow Paper (Set 1)**

### **8MA0-21 AS Statistics**

#### **October 2021 Shadow Paper mark scheme**

**Please note that this mark scheme is not the one used by examiners for making scripts. It is intended more as a guide, indicating where marks are given for correct answers. As such, it may not show follow-through marks (marks that are awarded despite errors being made) or special cases.**

**It should also be noted that for many questions, there may be alternative methods of finding correct solutions that are not shown here – they will be covered in the formal mark scheme from the original paper.**

**This document is intended for guidance only and may differ significantly from the examiners' final mark scheme for the original paper which was published in December 2020.**

#### **Guidance on the use of codes within this document**

M1 – method mark. This mark is generally given for an appropriate method in the context of the question. This mark is given for showing your working and may be awarded even if working is incorrect.

A1 – accuracy mark. This mark is generally given for a correct answer following correct working.

B1 – working mark. This mark is usually given when working and the answer cannot easily be separated.

Some questions require all working to be shown; in such questions, no marks will be given for an answer with no working (even if it is a correct answer).

Qu	Scheme	Marks	AO
1 (a)	$[p = 1 - (0.1 + 0.3 + 0.15 + 0.25)] = \underline{0.2}$	B1 (1)	1.1b
(b)	$B$ and $C$ are mutually exclusive. [ NOT $P(B)$ and $P(C)$ ]	B1 (1)	1.2
		(2 marks)	

Qu	Scheme	Marks	AO
2. (a)	From [5,30) fd = 2	M1	2.2a
	Correct bar above [0, 5)	A1	1.1b
	Correct bar above [30, 40)	A1	1.1b
		(3)	
(b)	For [60, 85) <b>5</b> passengers <u>or</u> for [40, 60) <b>50</b> passengers	M1	2.1
	For attempt to find total number of passengers = 166	A1ft	1.1b
	[Median = ] $30 + \left(\frac{10}{55} \times \frac{1}{2} 166 - 55\right)$ (o.e.)	M1	1.1b
	$= 35.0\dot{9}... = \text{awrt } \underline{35.1}$		
	<u>Or</u>		
	Use of $\frac{n+1}{2}$ acceptable giving 35.2	A1	1.1b
		(4)	
(c)	Upper outlier limit = $45.8 + 1.5 \times (45.8 - 23.25) = 79.63 < 85$	M1	2.4
	So oldest person is an outlier	A1	2.2a
		(2)	
		(9 marks)	

<b>Qu</b>	<b>Scheme</b>	<b>Marks</b>	<b>AO</b>
<b>3. (a)</b>	Systematic (sampling)	B1	1.2
<b>(b)(i)</b>	[Daily Mean] Wind Speed	B1	2.2a
<b>(ii)</b>	Moderate	B1	1.2
<b>(c)</b>	Variable A occurs most of the time or equivalent	B1	2.2b
		<b>(1)</b>	
		<b>(4 marks)</b>	

Qu	Scheme	Marks	AO
4. (a)	[ $T =$ no. of green tiles in the design] $T \sim B(13, 0.12)$	B1 (1)	3.3
(b)(i)	$P(T = 3) = 0.1376\dots$ awrt <b>0.138</b>	B1	1.1b
(ii)	$P(T > 5) = 1 - P(T < 4) = 1 - [0.98607\dots]$ $= 0.01393\dots$ awrt <b>0.0139</b>	M1 A1 (3)	3.4 1.1b
(c)	Requires $p = 0.12$ to be constant so need a large number of tiles in the sack to ensure that removing 13 tiles does not appreciably affect this probability, then it could be suitable.	B1 (1)	3.5b 2.5
(d)	$H_0: p = 0.12$ $H_1: p \neq 0.12$ [ $X =$ number of green tiles in the sample] $X \sim B(60, 0.12)$ $P(X \leq 3) = 0.060131\dots$ or if $B(60, 0.12)$ seen awrt 0.06 { $0.06 > 0.025$ accept $H_0$ } There is no evidence that the proportion of green tiles has changed	B1 M1 A1 A1 (4)	3.3 3.4 2.2b
(e)	$p$ -value is $p = 2 \times 0.06 = 0.12$	B1ft (1)	1.1b
		(10 marks)	

Qu	Scheme	Marks	AO
5	Must end up with 4 of each colour or 5 of each colour	M1	3.1b
	<b><u>n = 3</u></b> requires 1 <sup>st</sup> yellow and 2 <sup>nd</sup> red <u>or</u> yellow from <b>A</b> and red from <b>B</b>	M1	2.2a
	$P(1^{\text{st}} \text{ yellow and } 2^{\text{nd}} \text{ red}) = \frac{4}{11} \times \frac{5}{13} = \frac{20}{143} \quad p = \frac{20}{143}$	A1	1.1b
	<b><u>n = 6</u></b> requires 1 <sup>st</sup> green and 2 <sup>nd</sup> yellow <u>or</u> green from <b>A</b> and yellow from <b>B</b>	M1	2.2a
	$P(1^{\text{st}} \text{ green and } 2^{\text{nd}} \text{ yellow}) = \frac{2}{11} \times \frac{6}{16} = \frac{12}{176} \text{ or } \frac{3}{44} \quad p = \frac{3}{44}$	A1	1.1b
		(5)	
		(5 marks)	
<b>Notes</b>			