9709_w14_ms_63

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1		$z = -2.326$	B1		± 2.325 to ± 2.33 seen
		$\dfrac{250 - 260}{\sigma} = -2.326$	M1		Standardising and $=$ or $<$ their z, no cc, sq, sq rt
		$\sigma = 4.30$	A1	**3**	Correct ans

2	**(i)**	$0.7 - 2.4 + 2.2 - 0.5 + 6.3 + 4.9 + 0 + 0.3$ $= 11.5$	B1	**1**	
	(ii)	$(0.7^2 + 2.4^2 + 2.2^2 + 0.5^2 + 6.3^2 + 4.9^2 +$ $0.3^2)$ $= 75.13 \ (75.1)$	B1	**1**	
	(iii)	mean $= 63.4375$ Variance $= 75.13/8 - (11.5/8)^2$ $= 7.32$	B1✓ M1 A1	 **3**	ft $62 +$ their (i)/8 their(ii)/8 $- ((i)/8)^2$ correct answer
		OR mean $= 507.5/8 = 63.4375$ Var $= 32253/8 - 63.4375^2 = 7.32$	B1 M1 A1		 subst in correct variance or standard deviation formula correct answer – allow 6.62, 6.93–7.04, 7.260–7.325 Marks can be awarded in (i) or (ii) if not 'contradicted' by further working

3	**(i)**	max $= 12$ $P(12) = (0.7)^{12} = 0.0138$	B1 B1	 **2**	(Implied by $P(12)$ with power 12) Accept 0.014
	(ii)	P(fewer than 10) $= 1 - P(10, 11, 12)$ $= 1 - {}^{12}C_{10} \times (0.7)^{10}(0.3)^2 - 12 \times (0.7)^{11}(0.3)$ $- (0.7)^{12}$ $= 1 - 0.2528$ $= 0.747$	M1 A1 A1	 **3**	Binomial term ${}^{12}C_r(0.7)^r(0.3)^{12-r}$ or ${}^{12}C_r(p)^r(q)^{12-r}$, $0.99 \leqslant p + q \leqslant 1.00$ Correct unsimplified expression oe Correct answer

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4 (i)

Stem	leaf
1	4 5 7 8 9 9
2	1 2 2 3 4 5 6 6 8 8
3	0 2 6 8
4	1 2 5 6 7

Key 1|4 represents 14 glasses (of water)

B1   Correct stem (or reversed order)

B1   Correct leaves, ordered in numerical sequence, with ½ 'column' tolerance

B1   **3**   Key must include 'glasses' or similar drinking item

(ii) LQ = 20   Med = 26   UQ = 37

10   20   30   40   50

Glasses of water

B1   Correct median

B1   Correct quartiles

B1√   Correct on diagram ft any wrong med or quartiles. Linear scale based upon 3 quartiles plotted

B1   Correct end points of attached whiskers not through box

B1   **5**   Linear axis, label, both must be seen

SC No values stated

3 quartiles on diagram in correct relative positions   B2

End points of attached whiskers not through box correct relative to quartiles   B1

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5 (i) $P(<1.2)=P\left(z<\dfrac{1.2-1.9}{0.55}\right)=P(z<-1.2727)$

$=1-\Phi(1.273)=1-0.8986$

$=0.1014$

$P(>2.5)=P\left(z<\dfrac{2.5-1.9}{0.55}\right)=P(z>1.0909)$

$=1-\Phi(1.0909)=1-0.8623$

$=0.138$

$P(1.2<wt<2.5)=1-0.101-0.138$

$=0.761$

M1   Standardising for wt 1.2 or 2.5, no cc, sq, sq rt. May be awarded in (ii) if not attempted in (i) Accept 0.102

A1   First correct proportion seen

A1   Second correct proportion seen

M1   Third proportion 1 – their previous 2 proportions or correct attempt for remaining proportion

A1√   **5**   Correct answer or 1 – *their* 2 previous correct proportions

(ii) $P(x>k)=0.8+0.1377=0.9377$

$z=-1.536$

$-1.536=\dfrac{k-1.9}{0.55}$

$k=1.06$

M1   Valid method to obtain $P(x>k)$ or $P(x<k)$

A1   ± 1.536 seen accept 3sf rounding to 1.53 or 1.54

M1   Attempt to solve equation with their 'correct' area z value, k, 1.9 and 0.55

A1   **4**   Correct answer or rounding to 1.05

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6	(a)	1*****3 or 3*****1 or 2*****2	M1	Mult by 6^5 (for middle 5 dice outcomes)
		$= 6^5 \times 3$	M1	Mult by 3 or summing 3 different combinations (for end dice outcomes)
		$= 23328$	A1 3	Correct answer accept 23 300
	(b)	W J H		
		1 1 7 $= {}^9C_1 \times {}^8C_1 \times 1 = 72$	M1	Multiplying 3 combinations (may be implied)
		1 7 1 $= {}^9C_1 \times {}^8C_7 \times 1 = 72$	A1	1 unsimplified correct answer (72, 504, 1680, 216 or 3024)
		7 1 1 $= {}^9C_7 \times {}^2C_1 \times 1 = 72$		
		1 3 5 $= {}^9C_1 \times {}^8C_3 \times 1 = 504$ mult by 3!	A1	A 2nd unsimplified different correct answer
		3 3 3 $= {}^9C_3 \times {}^6C_3 \times 1 = 1680$	M1	Summing options for 1,1.7 or 1,3,5 oe (mult by 3 or 3!)
			M1	Summing at least 2 different options of the 3
		Total 4920	A1 6	Correct ans
		If no marks gained		If games replaced M1M1M1 max available
		Listing all 10 different outcomes	SCM1	If factorials used M0M1M1 max available
7	(a)	(i) P(X = 3) = P(GRR) + P(RGR)	M1	Mult 3 probs
		$\frac{2}{4} \times \frac{2}{3} \times \frac{1}{2} + \frac{2}{4} \times \frac{2}{3} \times \frac{1}{2}$	M1	Summing 2 options
		$\frac{1}{3}$ **AG**	A1 3	Correct working with appropriate justification and fraction sequencing

(ii)

X	2	3	4
Prob	$\frac{1}{6}$	$\frac{1}{3}$	$\frac{1}{2}$

B1 — Values 2, 3, 4 only in table. Condone $X=0,1$ if P(X)=0 stated

$$P(X = 2) = P(RR) = \frac{2}{4} \times \frac{1}{3} = \frac{1}{6}$$

B1 — One correct prob other than (i)

$$P(X = 4) = 1 - \left(\frac{1}{6} + \frac{1}{3}\right) = \frac{1}{2}$$

Or P(GGRR) + P(RGGR) + P(GRGR)

$$= \left(\frac{2}{4} \times \frac{1}{3} \times \frac{2}{2} \times \frac{1}{1}\right) \times 3 = \frac{1}{2}$$

B1√ 3 — Second correct prob ft 1 – their previous 2 probs

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(iii) P(3 orange | at least 2 O) =

$$\frac{P(3O)}{P(at\ least\ 2O)}$$

P(3 orange) = P(OOO)

$$= \frac{5}{7} \times \frac{4}{6} \times \frac{3}{5} = \frac{2}{7}$$

| | | M1 | Atttempt at P(OOO) one three-factor option, not added |
| | | A1 | Correct unsimplified num of a fraction |

P(at least 2O) = P(YOO) + P(OYO) +

P(OOY) + $\frac{2}{7}$

$$= \frac{2}{7} \times \frac{5}{6} \times \frac{4}{5} + \frac{5}{7} \times \frac{2}{6} \times \frac{4}{5} + \frac{5}{7} \times \frac{4}{6} \times \frac{2}{5} + \frac{2}{7}$$

| | | M1 | Attempt at P(at least 2O) sum 3 or 4 three-factor options |

$$= \frac{6}{7}$$

| | | A1 | Correct unsimplified answer seen anywhere |

$$P(3O\ |\ at\ least\ 2O) = \frac{2}{7} \div \frac{6}{7} = \frac{1}{3}\ (0.333)$$

| | | A1 | **5** | Correct answer evaluated |

<u>Alternative 1</u>
3 Orange = $^5C_3$

| | | M1 | Attempt at combinations for 3 orange oe, not added |
| | | A1 | Correct unsimplified num of a fraction |

At least 2 Orange = $^5C_2 \times {}^2C_1 + {}^5C_3$

| | | M1 | Attempt at combinations for at least 2 orange condone omission of $+{}^5C_3$ |
| | | A1 | Correct unsimplified answer seen anywhere |

$$P(3O\ |\ at\ least\ 2O) = \frac{{}^5C_3}{{}^5C_2 \times {}^2C_1 + {}^5C_3} = \frac{1}{3}$$

| | | A1 | **5** | Correct answer evaluated |

<u>Alternative 2</u>
No Yellow = $^2C_0$

| | | M1 | Attempt at combinations for 0 yellow oe, not added |
| | | A1 | Correct unsimplified num of a fraction |

No more than 1 Yellow = $^2C_1 + {}^2C_0$

| | | M1 | Attempt at combinations for no more than 1 yellow. Condone omission of +2C0 |
| | | A1 | Correct unsimplified answer seen anywhere |

$$P(3O\ |\ at\ least\ 2O) = \frac{{}^2C_0}{{}^2C_1 + {}^2C_0} = \frac{1}{3}$$

| | | A1 | **5** | Correct answer evaluated |

<u>Misread – with replacement</u>
MR–1 applied to first Accuracy Mark earned

| | | M1 | Attempt at P(OOO) one three factor option oe not added |

$$P(3O) = \frac{5}{7} \times \frac{5}{7} \times \frac{5}{7} = \frac{125}{343}$$

| | | A1 | Correct unsimplified num of a fraction |

$$P(at\ least\ 2O) = \frac{5}{7} \times \frac{5}{7} \times \frac{2}{7} \times {}^3C_2 + \left(\frac{5}{7}\right)^3$$

| | | M1 | Attempt at P(at least 2O) sum of 3 or 4 three factor options |
| | | A1 | Correct unsimplified seen anywhere |

$$P(3O\ |\ at\ least\ 2O) = \frac{5}{11}$$

| | | A1 | **4 max** | Answer evaluated |