Question	Answer	Marks	Guidance
1	$z = 1.037$ $1.037 = \frac{1.8-1.62}{\sigma}$ $\sigma = 0.18/1.037 = 0.174$	**B1** **M1** **A1** [3]	Rounding to 1.04 Standardising attempt allow cc no sq rt must have a z-value i.e. not 0.8023 or 0.5596.
2	P (throwing a 4) = (1 – 0.4) / 4 = 0.15 P(at most 1) = P(0, 1) or 1 – P(2, 3) $= (0.85)^3 + {}^3C_1\ (0.15)\ (0.85)^2$ = 0.939	**M1** **A1** **M1** **M1** **A1** [5]	Sensible attempt to find P(1) Correct answer A binomial term with ${}^3C_n$ oe any p Binomial expression with ${}^3C_n$ P(0, 1) or 1 – P(2, 3) $p = 0.15$ or 0.85
3 (i)	P (cup of coffee) = 0.6×0.9 + 0.4× 0.3 = 0.66	**M1** **A1** [2]	Summing two 2-factor probabilities Correct answer accept 0.660
(ii)	P(Not on time | no cup of coffee) $= \frac{P(\text{not on time} \cap \text{no cup})}{P(\text{no cup})} = \frac{0.4\times 0.7}{1-0.66}$ $= \frac{0.28}{0.34} = 0.824$	**M1** **M1** **A1** [3]	0.4×0.7 seen as num or denom of a fraction Attempt at P(no cup) as $0.1\times p_1 + 0.7\times p_2$ or as 1 – (i) seen anywhere
4	[P(X = 0)] = P(B, B) = 5/7×4/6 = 10/21 [P(X = 1)] = P(G,B) + P(B,G) = 2/7×5/6 ×2 = 10/21 [P(X = 2] = P(G, G) = 2/7×1/6 = 1/21 E(X) = 0 + 10/21 + 2/21 = 4/7 (0.571) Var(X) = 0 + 10/21 + 4/21 – $(4/7)^2$ = 50/147 (0.340)	**M1** **A1** **A1** **B1**√ **M1** **A1** [6]	Attempt to find P(0) or P(1) or P(2) can be seen as P(BB) etc. or table unsimplified P(1) or P(BG)+P(GB) correct P(0) or P(2) correct must see X value Correct answer ft their probs P(1) and P(2) Attempt at $\Sigma x^2 p - [\mathrm{E}(X)]^2$
5 (i)	$\mathrm{P}(x < 3.0) = \mathrm{P}\left(z < \frac{3.0-2.6}{0.25}\right)$ + P(z < 1.6) = 0.945	**M1** **M1** **A1** [3]	Standardising no sq rt no cc Correct area i.e. prob > 0.5 legit
(ii)	X~B(500, 0.9452) ~ N(472.6, 25.898) $\mathrm{P}\left(z > \frac{479.5-472.6}{\sqrt{25.89848}}\right) = \mathrm{P}\ (z > 1.3558)$ = 1 – 0.9125 = 0.0875	**M1** **M1** **M1** **M1** **A1** [5]	500 ×'0.9452' and 500×'0.9452'×('1 – 0.9452') seen oe Standardising must have sq rt. All M marks indep cc either 479.5 or 480.5 seen correct area i.e. < 0.5

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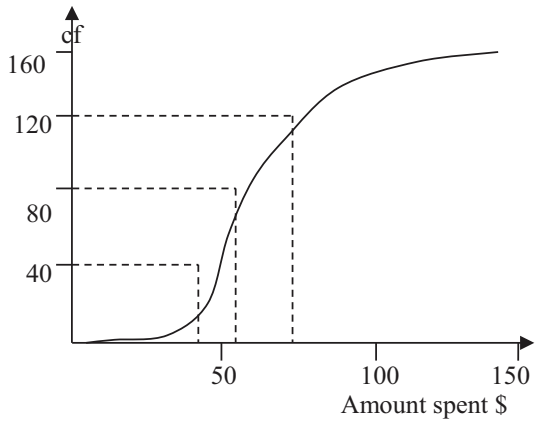
(iii)	500× 0.9452 and 500× (1–0.9452) are both > 5	B1√ [1]	must see at least 500× 0.0548 > 5oe ft their (i) accept $np > 5$, $nq > 5$ if both not $npq > 5$
6 (a) (i)	9 × 9 × 8 = 648 OR 900 – 28 × 9 = 648	M1 M1 A1 [3]	Logical listing attempt
(ii)	(7….in 1 × 8 × 4 = 32 ways 8 …in 1 × 8 × 5 = 40 9… in 1 × 8 × 4 = 32 Total 104 ways	M1 M1 M1 A1 [4]	Listing #s starting with 7 or 9 and ending odd
(b)	R(6) T(5) D(4) 2 2 3 = $^6C_2\times^5C_2\times^4C_3 = 600$ 2 3 2 = $^6C_2\times^5C_3\times^4C_2 = 900$ 3 2 2 = $^6C_3\times^5C_2\times^4C_2 = 1200$ Total = 2700	 M1 M1 A1 A1 [4]	Mult 3 combs, $^6C_x\times^5C_y\times^4C_z$ Summing 2 or 3 three-factor outcomes can be perms, + instead of × 2 options correct unsimplified
7 (i)	cf 16, 56, 104, 130, 160  	M1 B1 M1 A1 [4]	Attempt at cf table (up to 160) no graph needed accept %cf but give final linear scale minimum 0 to 160 and 0 to 120 Attempt to plot points at (30, 16), (50, 56), (70,104), (90, 130), (140, 160) up to 2 errors can have a polygon All points correct from their scale and joined up, with (0,0) as well
(ii)	median $59 IQR = 82 – 43 = $39	B1√ M1 A1√ [3]	accept 57–60 or ft their graph if used lb, midpts instead of ub or assume linear interpolation. Subt a (sensible) LQ from a sensible UQ (generous) Ans ft need a cf graph and UQ 80–84, LQ

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(iii)	160 – 149 = 11 OR 115 is mid pt of last interval so # of shoppers is 30/2 = 15 (can be implied)	**M1** **A1** [2]	41–46 Subtracting from 160 can be implied Correct answer accept 9–16
(iv)	mean = (15×16+ 40×40 +60×48+ 80×26 + 115×30)/160 = 10250/160 = \$64.1= \$64.1	**M1** **A1** [2]	Using $\Sigma xf/160$ with mid-points

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