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\begin{tabular}{|c|c|c|c|}
\hline \(1 \quad \bar{x}=59.4\)
\[
\sigma=7.68
\] \& \begin{tabular}{l}
B1 \\
M1 \\
A1
\end{tabular} \& [3] \& \begin{tabular}{l}
Correct method (can be implied by correct answer) \\
Correct answer
\end{tabular} \\
\hline 2 (i)
\[
\begin{aligned}
\& \text { each in } 2 \text { ways }=2^{12} \\
\& =4096
\end{aligned}
\]
\[
\text { (ii) } \begin{aligned}
\& \frac{12!}{7!5!} \\
\& =792
\end{aligned}
\] \& \begin{tabular}{l}
M1 \\
A1
B1
\end{tabular} \& [2]
[1] \& \begin{tabular}{l}
\[
2^{12} \text { seen }
\] \\
Correct answer
\end{tabular} \\
\hline \begin{tabular}{l}
3 (a) \(G R L\) \\
\(117 \quad 7=15 \mathrm{C} 11 \times 10 \mathrm{C} 7 \times 8 \mathrm{C} 7=1310400\) \\
\(1366=15 \mathrm{C} 13 \times 10 \mathrm{C} 6 \times 8 \mathrm{C} 6=617400\) \\
\(1555=15 \mathrm{C} 15 \times 10 \mathrm{C} 5 \times 8 \mathrm{C} 5=14112\) \\
Total \(=1941912\) (1940000) \\
(b) e.g. \(* \mathrm{E} * \mathrm{R} * \mathrm{E}(\mathrm{GG}) \mathrm{N} * \mathrm{~A} * \mathrm{E} *\) gives 6 ways for \(G\)
\[
\begin{aligned}
\& \frac{7!}{3!} \times 6 \text { or } 8!/ 3!-2 \times 7!/ 3! \\
\& =5040 \text { ways. }
\end{aligned}
\]
\end{tabular} \& \begin{tabular}{l}
M1 \\
A1 \\
M1 \\
A1 \\
B1 \\
B1 \\
B1
\end{tabular} \& [4] \& \begin{tabular}{l}
Multiplying 3 combinations \\
One of \(1310400,617400,14112\) seen \\
Adding 3 options \\
Correct answer \\
7! / 3! Or 7!/3!3! seen oe \\
Multiplying by 6 (gaps) oe \\
Correct final answer
\end{tabular} \\
\hline \begin{tabular}{l}
4 (i) \(45-50 \mathrm{~g}\) \\
(ii) LQ in \(40-45\) \\
UQ in \(50-60\) \\
Smallest IQ range could be 5 \\
Largest IQ range could be 20 \\
(iii) 50 \\
(iv) freqs \(0,20,30,50,60,50,10\) \\
\(\mathrm{fd} \quad 0,2,3,10,12,5,1\)
\end{tabular} \& \begin{tabular}{l}
B1 \\
M1 \\
A1 \\
B1 \\
M1 \\
B1 \\
B1 \\
A1
\end{tabular} \& \([1]\)
\([2]\)
\([1]\)

[4] \& | Considering groups containing LQ and UQ (can be implied) Correct answer |
| :--- |
| Attempt at frequencies and fd |
| Correct labels and scales with a histogram-type shape |
| Correct bar widths starting at 20 |
| Correct heights of bars | \\

\hline | 5 (i) $4 p+p+3 p=1$ so $\mathrm{P}($ blue $)=1 / 8 \mathrm{AG}$ |
| :--- |
| (ii) $\begin{aligned} & \mathrm{P}(R)=1 / 2, \mathrm{P}(B)=1 / 8, \mathrm{P}(G)=3 / 8 \\ & \mathrm{P}(\text { all different })=1 / 2 \times 1 / 8 \times 3 / 8 \times 3! \\ & =9 / 64(0.141) \end{aligned}$ | \& \[

$$
\begin{array}{|l}
\mathrm{B} 1 \\
\text { M1 } \\
\text { M1 } \\
\text { A1 }
\end{array}
$$

\] \& [1] \& | Must show something |
| :--- |
| Multiplying $\mathrm{P}(R, B, G)$ together Mult by 3! |
| Correct answer | \\

\hline
\end{tabular}

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\begin{tabular}{|c|c|c|c|}
\hline \[
\begin{aligned}
\& \text { (iii) } \text { mean }=136 \times 1 / 8=17, \mathrm{var}=14.875 \\
\& \mathrm{P}(<20)=\mathrm{P}\left(z<\frac{19.5-17}{\sqrt{14.875}}\right) \\
\& =\Phi(0.648) \\
\& =0.742
\end{aligned}
\] \& \begin{tabular}{l}
B1 \\
M1 \\
M1 \\
M1 \\
A1
\end{tabular} \& [5] \& \begin{tabular}{l}
Unsimplified mean and variance correct \\
Standardising, need sq rt \\
Cont correction 19.5 or 20.5 \\
Correct area, \(>0.5\) legit \\
Correct answer
\end{tabular} \\
\hline \begin{tabular}{l}
6 (i)
\[
\begin{aligned}
\& \mathrm{P}(0,1,2) \\
\& =(0.85)^{6}+(0.15)(0.85)^{5}{ }_{6} \mathrm{C}_{1}+ \\
\& (0.15)^{2}(0.85)^{4}{ }_{6} \mathrm{C}_{2} \\
\& =0.953
\end{aligned}
\] \\
(ii)
\[
\begin{aligned}
\& \mathrm{P}(D)=0.6 \times 0.1+0.4 \times 0.55=0.28 \\
\& \mathrm{P}(B \mid D)=\frac{P(B \cap D)}{P(D)} \\
\& 0.06 / 0.28=0.2143 \\
\& \mathrm{P}(>1)=1-\mathrm{P}(0) \\
\& =1-(0.7857)^{5} \\
\& =1-0.7078 \\
\& =0.701
\end{aligned}
\]
\end{tabular} \& \begin{tabular}{l}
B1 \\
M1 \\
A1 \\
M1 \\
A1 \\
M1 \\
\(\sqrt{ } \mathrm{A} 1\) \\
M1 \\
A1
\end{tabular} \& [3] \& \begin{tabular}{l}
0.15 and 0.85 seen \\
Any binomial expression \(\Sigma\) powers \(=6\), \\
\(\Sigma \mathrm{p}=1\) \\
Correct answer \\
Attempt to find \(\mathrm{P}(D)\) \\
0.28 seen \\
Using cond prob formula to find \(\mathrm{P}(B \mid D)\) \\
Correct unsimplified answer \\
Binomial expression \(1-\mathrm{P}(0)\) or \(1-\mathrm{P}(0\), \\
1) \(\Sigma p=1\) \\
Correct answer accept 0.700
\end{tabular} \\
\hline \begin{tabular}{l}
7 (i)
\[
\begin{aligned}
\& \mathrm{z}_{1}=\frac{12-8}{\sqrt{24}}=0.816 \Phi_{1}(0.816)=0.7926 \\
\& \mathrm{z}_{2}=\frac{7-8}{\sqrt{24}}=-0.204 \Phi_{2}(-0.204)=1-0.5808 \\
\& \text { Prob }=0.7926-(1-0.5808)=0.373
\end{aligned}
\] \\
(ii)
\[
\begin{aligned}
\& \mathrm{z}=\frac{0-\mu}{2 \mu}=-0.5 \\
\& \mathrm{P}(\mathrm{z}<-0.5)=1-0.6915 \\
\& =0.309 \text { or } 30.9 \%
\end{aligned}
\] \\
(iii)
\[
\begin{aligned}
\& \mathrm{z}=\frac{3 \mu-\mu}{2 \mu}=1 \\
\& \mathrm{P}(\mathrm{z}>1)=1-0.8413=0.1587 \\
\& 70 \times 0.1587=11.1
\end{aligned}
\] \\
(iv) \(\mathrm{z}=1.45\)
\[
\begin{aligned}
\& 1.45=\frac{6-\mu}{2 \mu} \\
\& \mu=1.54
\end{aligned}
\]
\end{tabular} \& \begin{tabular}{l}
M1 \\
M1 \\
A1 \\
M1 \\
A1 \\
M1 \\
M1 \\
A1 \\
B1 \\
M1 \\
A1
\end{tabular} \& [3]
[2]

[3]

[3] \& | Correct area $\Phi_{1}+\Phi_{2}-1$ |
| :--- |
| Correct answer |
| Standardising, no cc no sq rt, one variable |
| Correct answer oe |
| Standardising and eliminating $\mu$ |
| Subt from 1 and multiplying by 70 |
| Correct answer accept 11 or 12 $\pm 1.45 \text { seen }$ |
| Solving for $\mu$ with $6,2 \mu, \mu$ and their z |
| Correct answer | \\

\hline
\end{tabular}

