(1)

S1 Jan 07 - Solutions

1. a) $20-3 = \underline{17}$

b) $S_{tt} = \Sigma t^2 - \frac{(\Sigma t)^2}{n} = 5478 - \frac{(212)^2}{10} = \underline{983.6}$

$S_{mm} = \Sigma m^2 - \frac{(\Sigma m)^2}{n} = 2101 - \frac{(61)^2}{10} = \underline{1728.9}$

$S_{tm} = \Sigma tm - \frac{\Sigma t \Sigma m}{n} = 2485 - \frac{212 \times 61}{10} = \underline{1191.8}$

c) $PMCC = r = \frac{S_{tm}}{\sqrt{S_{tt} S_{mm}}} = \frac{1191.8}{\sqrt{983.6 \times 1728.9}} = \underline{0.914}$ (3sf)

d) 0.914 coding does not effect the PMCC

e) • 0.914 implies the longer spent shopping the more money spent.
• 0.178 shows little or no correlation implying that the amount of time spent shopping had no bearing on the amount spent.

f) One could be measured during a sale.

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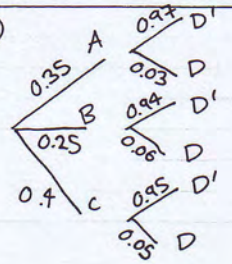
2. a)



b) i) $P(A \cap D) = 0.35 \times 0.03 = \underline{0.0105}$

ii) $P(D) = 0.0105 + 0.25 \times 0.06 + 0.4 \times 0.05 = \underline{0.0455}$

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(2)

c) $P(C|D) = \frac{P(C \cap D)}{P(D)} = \frac{0.4 \times 0.05}{0.0455} = \underline{0.440}$ (3sf)

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3. a)

X	1	2	3	4	5	6
P(X=x)	$\frac{1}{36}$	$\frac{3}{36}$	$\frac{5}{36}$	$\frac{7}{36}$	$\frac{9}{36}$	$\frac{11}{36}$

b) $P(2 < X \leq 5) = P(X = 3,4,5) = \frac{5+7+9}{36} = \underline{\frac{21}{36}}$

c) $E(X) = \frac{1}{36} + \frac{6}{36} + \frac{15}{36} + \frac{28}{36} + \frac{45}{36} + \frac{66}{36} = \underline{\frac{161}{36}}$

d) $Var(X) = E(X^2) - [E(X)]^2$

$E(X^2) = \frac{1}{36} + \frac{12}{36} + \frac{45}{36} + \frac{112}{36} + \frac{225}{36} + \frac{396}{36}$

$= \frac{791}{36}$

$\therefore Var(X) = \frac{791}{36} - \left(\frac{161}{36}\right)^2 = \underline{1.97}$ (3sf)

e) $Var(2-3X) = (-3)^2 \times 1.97$

$= \underline{17.73}$

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(3)

4. a) Positive shew.

b) $\frac{120}{2} = 60$ in 20-29 class

$Q_2 = 19.5 + \frac{(60-29)}{43} \times 10 = \underline{26.7}$ (3sf)

c) $\mu = \frac{\Sigma fx}{\Sigma f} = \frac{3550}{120} = \underline{29.6}$ (3sf)

$\sigma = \sqrt{\frac{\Sigma fx^2}{\Sigma f} - \mu^2} = \sqrt{\frac{138020}{120} - (29.583\ldots)^2}$

$= \underline{16.6}$ (3sf)

d) $\frac{3(29.6-26.7)}{16.6} = \underline{0.5}$

e) Yes as the coefficient is positive $\Rightarrow$ positive shew.

f) median, as mean is effected by shew.

g) No shew.

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5. a) continuous data.

b) Area represents frequency.

c) Area of rectangle $= 3.6 \times 2 = 7.2 cm^2$ Frequency $= 9$

$\therefore \frac{9}{7.2} = \underline{0.8 cm^2}$

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(4)

d) $\frac{24}{0.8} = 30$ pupils

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6. a) • Simplify complicated problems.
• Provide a quick and cheap solution.

b) Stage 3 Expected values are calculated
Stage 4 Data is collected.
Stage 7 The model is revised and improved

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7. a) $IQ \sim N(100, 15^2)$

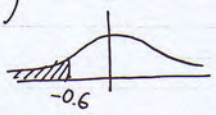
$P(IQ < 91) = P\left(Z < \frac{91-100}{15}\right)$

$= P(Z < -0.6)$

$= P(Z > 0.6)$

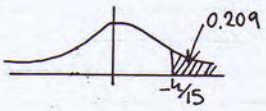
$= 1 - P(Z < 0.6)$

$= 1 - \Phi(0.6) = 1 - 0.7257 = \underline{0.2743}$



b) $P(IQ > 100 + k) = 0.2090$

$P\left(Z > \frac{k}{15}\right) = 0.2090$



$P\left(Z < \frac{k}{15}\right) = 0.791$

$\Phi\left(\frac{k}{15}\right) = 0.791$ $\quad \frac{k}{15} = 0.81$ $\quad k = 12.15$

$k = 12$