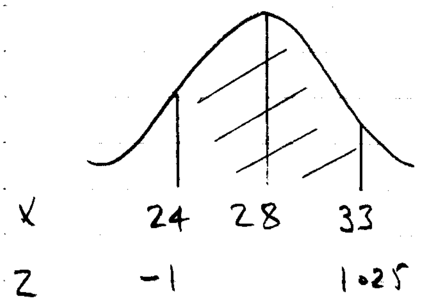
MEI STATISTICS 2 JANUARY 2007 Q2 NORMAL

2a) i) $X \sim N(28, 4^2)$



$x = 33$, $z = \dfrac{x-\mu}{\sigma}$

$z = \dfrac{33-28}{4} = 1.25$

$x = 24$ $z = \dfrac{24-28}{4} = -1$

$$P(24 < X < 33) = P(-1 < Z < 1.25)$$

$$= \Phi(1.25) - (1 - \Phi(1))$$

$$= \Phi(1.25) + \Phi(1) - 1$$

$$= 0.8944 + 0.8413 - 1$$

$$= 0.7357$$

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ii) $P(X < 24) = 1 - \Phi(1) = 1 - 0.8413 = 0.1587$

$P(24 < X < 33) = 0.7357$

(£) Income $25000 \times 0.1587 \times 0.05$

$+ \ 25000 \times 0.7357 \times 0.10 = £2037.63$

$= £2038$ to nearest pound

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iii) $X \sim N(\mu, 4^2)$

$z = \Phi^{-1}(0.95)$
$z = 1.645$

$z = \dfrac{x-\mu}{\sigma}$

$\sigma z = x - \mu$

$\mu = x - \sigma z$

$\mu = 33 - 4 \times 1.645 = 26.42$ mm

2b) i) $X \sim N\left(0.155, \sqrt{0.005}^{\,2}\right)$

Distribution for sample of 25 $\quad X \sim N\left(0.155, \left(\frac{\sqrt{0.005}}{\sqrt{25}}\right)^2\right)$

$H_0 : \mu = 0.155$ kg

$H_1 : \mu > 0.155$ kg

μ is the mean weight of whole population of new variety of onions

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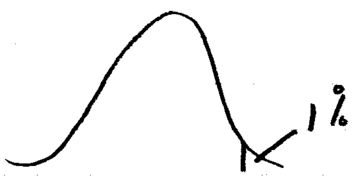
ii) Total sample weight $= 4.77$ kg

$\Rightarrow$ sample mean weight $= \frac{4.77}{25} = 0.1908$ kg



$z = \Phi^{-1}(0.99)$

For 1% significance level

$z = \Phi^{-1}(0.99) = 2.326$

$$z = \frac{x - \mu}{\frac{\sigma}{\sqrt{25}}} \qquad z = \frac{0.1908 - 0.155}{\frac{\sqrt{0.005}}{\sqrt{25}}} = 2.531$$

Since $2.531 > 2.326$

Reject H_0 and accept H_1

There is sufficient evidence to suggest that the new variety yields a mean weight > 0.155 kg

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