Advanced Higher Applied Mathematics 2004
Solutions for Section E (Statistics 1)

E1. (a) Stratified **1**

and Quota [or Quota (convenience)] **1**

(b) Approach (a) should be best **1**

since (b) is not random (other forms e.g. Glasgow not typical, biased) **1**

E2. (a) $F \sim Bin(192, 0.002)$. **1 for distribution**
1 for parameters

(b) $P(F \geqslant 3) = 1 - P(F \leqslant 2)$ **1**

$= 1 - (0.6809 + 0.2620 + 0.0501)$ **1**

$= 0.0070$ **1**

Notes: applying a Poisson distribution loses (at least) one mark; a Normal distribution loses two marks.

(c) Approximate using the $Poi(0.384)$ **1 for distribution**
1 for parameters

E3. Assume that yields are normally distributed. **1**

Assume that the standard deviation is unchanged. **1**

$\bar{x} = 404.2$.

A 95% confidence interval for the mean yield, μ, is given by:–

$\bar{x} \pm 1.96 \dfrac{\sigma}{\sqrt{n}}$ **1**

$404.2 \pm 1.96 \dfrac{10.}{\sqrt{5}}$

404.2 ± 8.8 **1**

or (395.4, 413.0).

The fact that the confidence interval does not include 382 **1**

provides evidence, at the 5% level of significance, of a **1**

change in the mean yield.

E4. TNE = 3% of 500 = 15 **1**

With maximum allowable standard deviation

$P(\text{weight} < 485) = 0.025$ **1**

$\Rightarrow \dfrac{485 - 505}{\sigma} = -1.96$ **1,1**

$\Rightarrow \sigma = \dfrac{20}{1.96} = 10.2$ **1**

There will be a small probability of obtaining a content

weight less than 470g with the normal model. **1**

E5. (a) P(Alaskan fish classified as Canadian)

$= P(X > 120 \mid X \sim N(100, 20^2))$ **1**

$= P\left(Z > \frac{120 - 100}{20}\right)$

$= P(Z > 1)$ **1**

$= 0.1587$ **1**

(b) The probability is the same as in (a) because of symmetry. **1**

(c) P(Canadian origin | Alaskan predicted)

$= \frac{P(\text{Alaskan predicted and Canadian origin})}{P(\text{Alaskan predicted})}$ **1**

$= \frac{P(\text{Alaskan predicted but Canadian origin})}{P(\text{Ala pred and Alaskan}) + P(\text{Ala pred but Canadian})}$ **1**

$= \frac{0.4 \times 0.1587}{0.6 \times 0.8413 + 0.4 \times 0.1587}$ **1,1**

$= \frac{0.06348}{0.50478 + 0.06348}$

$= 0.112.$ **1**

Note: Alternative methods acceptable e.g. Venn or Tree Diagrams