CAMBRIDGE
INTERNATIONAL EXAMINATIONS

NOVEMBER 2002

GCE Advanced Level
GCE Advanced Subsidiary Level

MARK SCHEME

MAXIMUM MARK : 50

SYLLABUS/COMPONENT :9709 /7, 8719 /7

MATHEMATICS
(Probability and Statistics 2)

UNIVERSITY of CAMBRIDGE
Local Examinations Syndicate

1 $51.2 \pm 2.576 \times \sqrt{\frac{37.4}{120}}$ $49.8 < \mu < 52.6$	M1 B1 A1 3	$\bar{x} \pm z\frac{s}{\sqrt{n}}$ Calculation of correct form Using $z = 2.576$ Or equivalent statement
2 (i) $0.015n = 2.55$ $n = 170$ **(ii)** mean = 210×0.015 (=3.15) P(0) + P(1) + P(2) = $e^{-3.15}\left(1+3.15+\frac{3.15^2}{2}\right)$ = 0.390 or 0.391 SR use of Binomial scores B1 for final correct answer 0.389	M1 A1 2 B1 M1 A1 3	For equation linking n, p and mean For correct answer For new mean For evaluating Poisson P(0) + P(1) + P(2) + [P(3)] For correct answer
3 (i) $z = \frac{64.3-65}{4.9/\sqrt{n}} = -1.807$ $n = 160$ **(ii)** H_0: $\mu = 65$ H_1: $\mu < 65$ Critical Value +/-1.645 Significant growth decrease	M1 M1 A1 3 B1 B1 M1 A1 4	For standardising equation = +/-1.807 with n or $\sqrt{n}$ Solving for n For correct answer CWO. For H_0 and H_1 For +/-1.645 (or ft +/- 1.96 for two tail test) Comparing given statistic with their CV Correct conclusion
4 (i) H_0: $\lambda = 4.8$ H_1 : $\lambda < 4.8$ Under H_0 P(0) = $e^{-4.8}$ (=0.00823) P(1) = 0.0395 P(2) = 0.0948 Critical region is $X = 0$ or 1 Not enough evidence to say road sign has decreased accidents SR If M0, M0 allow M1 for stating / showing P(0) + P(1) < 10% **(ii)** P(Type I error) = P(0) + P(1) = 0.0477	B1 M1 M1 A1 A1 5 M1 A1 2	For both H_0 and H_1 For evaluating P(0) and P(1) and P(2) For stating/showing that P(0) + P(1) + P(2) > 10% For critical region. Correct conclusion For identifying correct outcome For correct answer
5 (i) new mean = 5.6 $P(X+Y>3) = 1 - \{P(0)+P(1)+P(2)+P(3)\}$ $= 1 - e^{-5.6}(1+5.6+\frac{5.6^2}{2!}+\frac{5.6^3}{3!})$ = 0.809 **(ii)** $\bar{X} \sim N(2.5, \frac{2.5}{80})$ or equiv. method using totals N(200, 200) $P(X<2.4) = \Phi\left(\frac{2.4-2.5}{\sqrt{(2.5/80)}}\right)$ or $\Phi\left(\frac{192-200}{\sqrt{200}}\right)$ $= \Phi(-0.566)$ $= 1 - 0.7143 = 0.286$	B1 M1 A1 A1 4 M1 A1 M1 A1 4	For new mean For evaluating 1 – some Poisson probabilities For correct expression For correct answer For using normal distribution with mean 2.5 / 200 For correct variance For standardising and using normal tables For correct answer

6 (i) $k\int_{20}^{28}\frac{1}{x^2}dx=1$ $k\left[\frac{-1}{x}\right]=1$ $k\left[\frac{1}{20}-\frac{1}{28}\right]=1 \Rightarrow k=70$	M1 A1 A1 **3**	For equating to 1 and attempt to integrate Correct integration For given answer correctly obtained (no decimals seen).
(ii) $E(X)=\int_{20}^{28}k\frac{1}{x}dx = k[\ln x]$ $= 23.6, 23.5, 70\ln 1.4, 70\ln(7/5)$	M1 A1 A1 **3**	For attempt to evaluate $\int_{20}^{28}\frac{70}{x}dx$. For correct integration For correct answer
(iii) $P(X< E(X)) = \int_{20}^{23.55}\frac{70}{x^2}dx$ $= 0.528$ (accept 0.534 from 23.6) (0.521 23.5)	M1 A1 **2**	For attempt to evaluate $\int\frac{70}{x^2}dx$ between their limits (<28) For correct answer
(iv) Greater Prob in (iii) is > 0.5	B1ft B1ft **2**	For correct statement For correct reason. Follow through from (iii) or calculating med. = 23.3
7 (i) $W\sim N(17.6, 0.133(2))$ $\Phi\left(\frac{18-17.6}{\sqrt{0.1332}}\right)$ (= 0.8633) $\Phi\left(\frac{17-17.6}{\sqrt{0.1332}}\right)$ = 1 - 0.9499 (= 0.0501) 0.8633 - 0.0501 = 0.813	B1 B1 M1 M1 A1 **5**	For correct mean For correct variance For standardising and using tables For standardising and using tables For correct answer
(ii) Wt diff $D\sim N(0, 0.0072)$ $P(D>0.05) = 1-\Phi\left(\frac{0.05}{\sqrt{0.0072}}\right) = 1-\Phi(0.589)$ $= 0.278$ $P(D<0.05) = 0.278$ 0.278 + 0.278 = 0.556	B1 M1 A1 M1 A1 **5**	For correct mean and variance For standardising and using tables For 0.278 (could be implied) For finding the other probability For correct answer