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