Assessment Schedule – 2007

Statistics and Modelling: Use probability distribution models to solve straightforward problems (90646)

Evidence Statement

	Achievement Criteria	Qn No.	Evidence	Code	Judgement	Sufficiency
ACHIEVEMENT	Use probability distribution models to solve straight-forward problems.	1	Poisson distribution $P(x < 2; \lambda = 1)$ $= 0.7358$ (GC: 0.73575)	A	Or equivalent. CRO	***Achievement:*** TWO of Code A No repeated distributions allowed as evidence.
		2	Binomial distribution $P(X > 2; n = 10, \pi = 0.05)$ $= 1 - P(X \le 2)$ $= 1 - 0.98849$ $= 0.0116$ (GC: 0.01151)	A	Or equivalent. CRO	
		3(a)	Normal distribution $X \sim N(\mu = 12.4, \sigma = 3.0)$ $P(10 \le X \le 15)$ $= P(-0.8 \le Z \le 0.867)$ $= 0.2881 + 0.307$ $= 0.5951$ (GC: 0.59508)	A	Or equivalent. CRO Accept wrong or incorrect rounding.	

	Achievement Criteria	Qn No.	Evidence	Code	Judgement	Sufficiency
ACHIEVEMENT WITH MERIT	Use probability distribution models to solve problems.	3(b)	Inverse Normal distribution $P(X \geq k) = 0.02$ $Z = 2.054$ $k = 12.4 + 2.054 \times 3.0$ $= 18.56$ minutes (GC: 18.561)	A M	Ignore units. Or equivalent. CRO	***Merit:*** Achievement **plus** TWO of Code M **OR** THREE of Code M
		3(c)	Normal distribution $N(\mu = 12.4, \sigma = 3.0)$ $P(X < 8)$ $= P(Z < -1.467)$ $= 0.5 - 0.4289$ $= 0.0711$ (GC: 0.07124)	A	Or equivalent. CRO	
			Binomial distribution $P(X = 2; n = 6, \pi = 0.0711)$ $= 0.0565$ (GC: 0.05661)	or A M	Or equivalent. CRO	
		3(d)	Sum of two normally distributed independent random variables $T = X + Y$ $E(T) = 32.8 + 12.4 = 45.2$ min $\sigma(T) = \sqrt{11.9^2 + 3^2} = 12.2723$ $N(\mu = 45.2, \sigma = 12.2723)$ $P(X > 50)$ $= P(Z > 0.391)$ $= 0.5 - 0.1521$ $= 0.3479$ (GC: 0.34785)	A M	Or equivalent. CRO	

	Achievement Criteria	Qn No.	Evidence	Code	Judgement	Sufficiency
ACHIEVEMENT WITH EXCELLENCE	Use and justify probability distribution models to solve complex problems.	3(e)	Linear combination of independent random variables. $X \sim$ N(32.8 min, 11.9 min) $Y \sim$ N(12.4 min, 3.0 min) $C = \$50X + \$60Y$ $\mathrm{E}(C) = 50 \times \frac{32.8}{60} + 60 \times \frac{12.4}{60}$ $= \$39.73$ $\sigma(C)$ $= \sqrt{50^2 \times \left(\frac{11.9}{60}\right)^2 + 60^2 \times \left(\frac{3.0}{60}\right)^2}$ $= \$10.36$ $\mathrm{P}(X > 45)$ $= \mathrm{P}(Z > 0.509)$ $= 0.5 - 0.1946$ $= 0.3054$ (GC: 0.30549)	AME	Require evidence of linear combination used. Or equivalent.	***Excellence:*** Merit **plus** TWO of Code E
		4(a)	Poisson distribution • The occurrences of 'slow' callouts are at random. • The occurrence of 'slow' callouts are independent. • 'Slow' callouts can not occur simultaneously. • The probability of a 'slow' callout occurring is proportional to the size of the time interval.	E	Or equivalent Need TWO conditions listed with 'slow' callout mentioned in at least one.	
		4(b)	Inverse Poisson distribution $\mathrm{P}(X = 0) = 1 - 0.28 = 0.72$ $e^{-\lambda} = 0.72$ $\lambda = 0.3285$	AME	Or equivalent At least 2sf.	

Judgement Statement — 2007

Achievement	Achievement with Merit	Achievement with Excellence
Use probability distribution models to solve straightforward problems. $2 \times$ A No repeated distributions	Use probability distribution models to solve problems. **Achievement** *plus* $2 \times$ M *or* $3 \times$ M	Use and justify probability distribution models to solve complex problems. **Merit** *plus* $2 \times$ E

The following Mathematics specific marking conventions may also have been used when marking this paper:

- Errors are circled.
- Omissions are indicated by a caret (∧).
- **NS** may have been used when there was not sufficient evidence to award a grade.
- **CON** may have been used to indicate 'consistency' where an answer is obtained using a prior, but incorrect answer and **NC** if the answer is not consistent with wrong working.
- **CRO** is used when the 'correct answer only' is given and the assessment schedule indicates that more evidence was required.
- # may be used when a correct answer is obtained but then further (unnecessary) working results in an incorrect final answer being offered.
- **RAWW** indicates right answer, wrong working.
- **R** for 'rounding error' and **PR** for 'premature rounding' resulting in a significant round-off error in the answer (if the question required evidence for rounding).
- **U** for incorrect or omitted units (if the question required evidence for units).
- **MEI** may have been used to indicate where a minor error has been made and ignored.