

STEP III, 2006, Q12

- 12 Fifty times a year, 1024 tourists disembark from a cruise liner at a port. From there they must travel to the city centre either by bus or by taxi. Tourists are equally likely to be directed to the bus station or to the taxi rank. Each bus of the bus company holds 32 passengers, and the company currently runs 15 buses. The company makes a profit of £1 for each passenger carried. It carries as many passengers as it can, with any excess being (eventually) transported by taxi. Show that the largest annual licence fee, in pounds, that the company should consider paying to be allowed to run an extra bus is approximately

$$1600\Phi(2) - \frac{800}{\sqrt{2\pi}}(1 - e^{-2}),$$

where $\Phi(x) = \frac{1}{\sqrt{2\pi}} \int_{-\infty}^x e^{-\frac{1}{2}t^2} dt$.

[You should not consider continuity corrections.]



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