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|------|-------------------------------------------------------------------------------------|
| 1(a) | $e^{-3}(\frac{3^3}{3!} + \frac{3^4}{4!}) = e^{-3}(4.5 + 3.375) = 0.22404 + 0.16803$ |
|      | $= 0.392 \text{ (3 sf)}$                                                            |
|      |                                                                                     |
| 1(b) | $\lambda = 5$                                                                       |
|      | $1 - e^{-5}(1 + 5 + \frac{5^2}{2!}) = 1 - e^{-5}(1+5+12.5)$                         |
|      | $= 1 - (0.0067379 + 0.0336897 + 0.0842243)$                                         |
|      | $= 0.875 \text{ (3 sf)}$                                                            |
| 1(c) | $T \sim N(600, 600)$                                                                |
|      | $\frac{559.5-600}{\sqrt{600}} [= -1.653]$                                           |
|      | $\Phi(-1.653) = 1 - \Phi(1.653)$                                                    |
|      | $= 0.0492 \text{ (3 sf) or } 0.0491$                                                |
|      |                                                                                     |

|      |                                                                                                                                   |
|------|-----------------------------------------------------------------------------------------------------------------------------------|
| 2    | $\text{est } (\mu) = 499.5 \text{ or } 29970/60$                                                                                  |
|      | $\text{est } (\sigma^2) = \frac{60}{59} \left( \frac{14970300}{60} - '499.5'^2 \right) \text{ or } 1/59(14970300 - (29970)^2/60)$ |
|      | $= 4.83 \text{ or } 285/59$                                                                                                       |
|      | $H_0: \text{Pop mean (or } \mu) = 500$<br>$H_1: \text{Pop mean (or } \mu) \neq 500$                                               |
|      | $\frac{'499.5'-500}{\frac{\sqrt{'4.83'}}{\sqrt{60}}}$                                                                             |
|      | $= -1.762$                                                                                                                        |
|      | $'1.762' < 1.96 \text{ or } -'1.762' > -1.96$<br>$0.0390 > 0.025$                                                                 |
|      | There is insufficient evidence that [mean ] mass is not 500g                                                                      |
| 4(a) | $[2 \times] z \times \frac{\sigma}{\sqrt{n}} = 1.414 \times [2 \times] 1.645 \times \frac{\sigma}{\sqrt{n}} \quad [z = 2.326]$    |
|      | $2\Phi('2.326') - 1$                                                                                                              |
|      | $\alpha = 98 \text{ (3 sf)}$                                                                                                      |
|      |                                                                                                                                   |
| 4(b) | $\frac{90}{'98'} = \frac{45}{49} \text{ or } 0.918 \text{ (3 sf)}$                                                                |
|      |                                                                                                                                   |

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| 6(a) | $N(2.5 + 0.8, 0.05 + 0.02) = N(3.3, 0.07)$                                        |
|      | $\frac{3.55 - '3.3'}{\sqrt{0.07}} [= 0.945]$                                      |
|      | $1 - \Phi('0.945')$                                                               |
|      | $= 0.172 \text{ (3 sf)}$                                                          |
|      |                                                                                   |
| 6(b) | $E(D) = 2.5 - 3 \times 0.8 = 0.1$                                                 |
|      | $\text{Var}(D) = 0.05 + 3^2 \times 0.02 = 0.23$                                   |
|      | $\frac{0 - ('0.1')}{\sqrt{0.23}} [= -0.2085 \text{ or } 0.209 \text{ or } 0.208]$ |
|      | $\Phi(' -0.2085') = 1 - \Phi('0.2085')$                                           |
|      | $= 0.417 \text{ (3 sf) or } 0.418$                                                |
|      |                                                                                   |

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|------|--------------------------------------------------------------------------------------------------------------------------|
| 7(a) | $[f(x) = -\frac{3}{4}(x^2 - 8x + 15)]$                                                                                   |
|      | $-\frac{3}{4} \int_{4.5}^5 (x^2 - 8x + 15) dx$                                                                           |
|      | $= -\frac{3}{4} \left[ \frac{x^3}{3} - 4x^2 + 15x \right]_{4.5}^5$                                                       |
|      | $-\frac{3}{4} \left[ \frac{125}{3} - 100 + 75 - \left( \frac{4.5^3}{3} - 4 \times 4.5^2 + 15 \times 4.5 \right) \right]$ |
|      | $= \frac{5}{32} \text{ or } 0.15625 \text{ or } 0.156 \text{ (3 sf)}$                                                    |
| 7(b) | Median = 4                                                                                                               |
|      |                                                                                                                          |
| 7(c) | $1 - 2 \times ' \frac{5}{32} ', \text{ or } 2(0.5 - ' \frac{5}{32} ')$                                                   |
|      | $\frac{11}{16} \text{ or } 0.6875 \text{ or } 0.687 \text{ or } 0.688 \text{ (3 sf)}$                                    |
|      |                                                                                                                          |
|      |                                                                                                                          |