Edexcel A level Maths Statistical distributions

Topic assessment

1. Soup tins have a capacity of 625 ml. The volume of soup, X ml, dispensed into each tin is Normally distributed with mean 610 and standard deviation 8. If more than 625 ml is dispensed, the tin overflows.

   (i) Find the probability that the volume of soup dispensed into a tin is between 600 ml and 625 ml. [2]

   The proportion of tins containing at least 600 ml is too low. To increase this proportion to 95%, the dispenser is adjusted in such a way as to reduce the standard deviation of X while leaving the mean unchanged.

   (ii) Show that the new value of the standard deviation is 6.08. [4]

   (iii) Show that the proportion of tins overflowing is now 0.68%. [2]

2. A clothing manufacturer makes men's trousers in three different lengths: *Long*, *Medium* and *Short*. You may assume that the leg length of men can be modelled by a Normal distribution with mean 77 cm and standard deviation 3 cm. The *Medium* length trousers are suitable for men whose leg length is between 74.5 and 81.2 cm.

   (i) Draw a sketch of this Normal distribution, showing the mean. Indicate clearly the area representing *Medium* trousers. [2]

   (ii) Find the proportion of men for whom *Medium* trousers would be suitable. [2]

   Following complaints by a number of customers that the *Long* trousers are not long enough, the manufacturer introduces a new length, *Extra Long*, which is suitable for the 2% of men who have the longest legs.

   (iii) Find the shortest leg length for which the new *Extra Long* trousers would be suitable. [2]

3. The number of marks gained by candidates in a particular Statistics examination, for which the maximum mark is 60, is modelled by a Normal distribution with mean 36 and standard deviation 8. The marks are reported as integers.

   (i) Find the probability that a randomly chosen candidate scores exactly 30 marks. [3]

   (ii) Three candidates are chosen at random. Find the probability that just one of them gets fewer than 30 marks. [3]

   (iii) It is intended that the proportion of candidates receiving a grade A should be as near as possible to 20%. What is the lowest integer mark that should be awarded a grade A? [3]

   (iv) In a future Statistics examinations it is intended that the top 25% of candidates should gain a reported mark of at least 45. Determine the required value for the mean mark, assuming the standard deviation remains at 8. [4]

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4. Every day, Morse attempts the crossword puzzle in his newspaper. The time taken, X minutes, to complete the crossword may be modelled by a Normal distribution with mean 22 and standard deviation 4.5.

   (i) Calculate the probability that he takes
   (A) more than 25 minutes,
   (B) between 15 and 25 minutes
   to complete the crossword. [4]

   (ii) What length of time would be enough for Morse to finish the crossword on 95% of days? [2]

   (iii) Morse changes his newspaper and finds that on 99% of occasions he completes the crossword within 25 minutes. Assuming that the time taken, Y minutes, to complete the crossword has the distribution $N(18, \sigma^2)$, find the value of σ. [3]

5. *Extralite* are testing a new long-life bulb. The life-times, in hours, are assumed to be Normally distributed with mean μ and standard deviation σ. After extensive tests, they find that 19% of bulbs have a life-time exceeding 5000 hours, while 5% have a life-time under 4000 hours.

   (i) Show that $\sigma = 396$ and find the value of μ. [5]

   In the remainder of this question take μ to be 4650 and σ to be 400.

   (ii) Find the probability that a bulb chosen at random has a life-time between 4250 and 4750 hours. [2]

   (iii) *Extralite* wish to quote a life-time which will be exceeded by 99% of bulbs. What time, correct to the nearest 100 hours, should they quote? [2]

Total 45 marks