

COMS10003 Work Sheet 14

Random Variables II

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1. Prove that the variance of a uniformly distributed random variable with density as given below is $(U - L)^2/12$.

$$p(x) = \begin{cases} 1/(U - L) & L \leq x \leq U \\ 0 & \text{else} \end{cases}$$

2. Widgets are mass-produced. The target diameter is 45 mm but records show that the diameters are normally distributed with mean 45 mm and standard deviation 0.05 mm. An acceptable diameter is one within the range 44.95 mm to 45.05 mm. What proportion of the output is unacceptable?
3. The resistance of a strain gauge is normally distributed with a mean of 100 ohms and a standard deviation of 0.2 ohms. To meet the specification, the resistance must be within the range 100 ± 0.5 ohms. What percentage of gauges are unacceptable?
4. The Department estimates that 75% of the students taking undergraduate courses are in favour of studying of random variables as part of their studies. Use this estimate along with a normal distribution approximation to the binomial distribution to determine the probability that more than 780 students out of a random sample of 1000 will be in favour of studying random variables.
5. Overbooking of passengers on intercontinental flights is a common practice among airlines. Aircraft which are capable of carrying 300 passengers are booked to carry 320 passengers. If 10% of passengers who have a booking fail to turn up for their flights, what is the probability that at least one passenger who has a booking, will end up without a seat on a particular flight? Use the normal distribution approximation to the binomial distribution to obtain your answer.
6. Over a period of 12 hours 180 requests are made to a web server at random. What is the probability that in a four-hour interval the number of requests is between 50 and 70? Use the normal distribution approximation to the binomial distribution to obtain your answer.