

Mat-1.2620 Applied Probability B

1st intermediate exam 26th October 2012 / Kibble

Write clearly *on every sheet of paper* :

- Mat-1.2620 ApplProbB, 1st intermediate exam, 26th October 2012
- Your student identification number
- IN BLOCK LETTERS in the following order: your family name, your first name(s)
- Your degree programme and year of registration
- Your possible former names and degree programmes
- Signature

A calculator plus the collection of formulae and statistical tables by Mellin are allowed.

Justify all your answers adequately; e.g. a mere number without a justification as an answer will not give points.

1. (a) The use of plant appearance in prospecting for ore deposits is called geobotanical prospecting. One indicator of copper is a small mint with a mauve-coloured flower. Suppose that, for a given region, the probability that the soil has a high copper content is 0.3 and the probability that the mint is present is 0.23. If the copper content is high, the probability that mint is present is 0.7. Find the probability that the copper content is high and mint is present.

- (b) It is reported that 50% of all computer chips produced are defective. Inspection ensures that only 5% of the chips legally marketed are defective. Unfortunately, some chips are stolen before inspection. If 1% of all chips on the market are stolen chips, find the probability that a given chip is a stolen chip given that it is defective.

Assume that a computer chip which is on the market has either been inspected or it is a stolen chip.

2. Production line workers assemble 15 cars per hour. During a given hour, four cars are produced with improperly fitted doors. Three of the cars produced in that hour are selected at random and inspected. Find the probability that at most one will be found with improperly fitted doors if
 - (i) the cars are selected *with replacement*
 - (ii) the cars are selected *without replacement*.

3. (a) In a factory, there is a machine that produces nails. The weights of the nails X_i are independent and vary randomly according to a normal distribution with mean 10 g and variance 0.05 g^2 . The nails are packed into boxes so that there are always 1000 nails per box. Suppose that one box is chosen at random and its contents are weighed. What is the probability that the weight of the contents of the box, $\sum_{i=1}^{1000} X_i$, is less than 9.99 kg?
- (b) The lifetime X (in units of a month) of a particular component follows an exponential distribution with parameter $1/4$. Determine the probability that the component lasts longer than 6 months.

4. The number of phone calls received in one minute at a call center is a Poisson-distributed random variable with intensity parameter 200 calls/min. What is the probability that the number of calls received in 24 hours lies in the interval 287 000 – 287 950?

Instruction: Approximate using the normal distribution (the approximation follows from the central limit theorem).