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3

90646

NEW ZEALAND QUALIFICATIONS AUTHORITY
MANA TOHU MĀTAURANGA O AOTEAROA

National Certificate of Educational Achievement
TAUMATA MĀTAURANGA Ā-MOTU KUA TAEA

Level 3 Statistics and Modelling, 2004

90646 Use probability distribution models to solve straightforward problems

Credits: Four
9.30 am Monday 15 November 2004

Check that the National Student Number (NSN) on your admission slip is the same as the number at the top of this page.

Make sure you have a copy of the Formulae and Tables Booklet L3–STATF.

You should answer ALL the questions in this booklet.

If you need more space for any answer, use the page provided at the back of this booklet and clearly number the question.

Check that this booklet has pages 2–8 in the correct order and that none of these pages is blank.

YOU MUST HAND THIS BOOKLET TO THE SUPERVISOR AT THE END OF THE EXAMINATION.

Achievement Criteria	*For Assessor's use only*	
Achievement	**Achievement with Merit**	**Achievement with Excellence**
Use probability distribution models to solve straightforward problems. ☐	Use probability distribution models to solve problems. ☐	Use and justify probability distribution models to solve complex problems. ☐
Overall Level of Performance ☐		

You are advised to spend 30 minutes answering the questions in this booklet.

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Show **ALL** working.

QUESTION ONE

John has to pass through six sets of traffic lights on his way to work. If he has to stop at **more than** four sets of lights, then he will be late for work. The sets of traffic lights operate independently of each other. The probability that John will have to stop at any one of the sets of traffic lights is 0.4.

Find the probability that John will be late for work.

QUESTION TWO

The number of vehicles that a local petrol station serves between 10 am and 2 pm can be modelled by a Poisson distribution, with a mean of 12 vehicles per hour during this time.

Find the probability that no vehicle is being served during any given **10-minute interval**.

QUESTION THREE

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At Elizabeth and John's home the mail is delivered in the morning. The delivery times are normally distributed with a mean of 10:20 am and a standard deviation of 18 minutes.

(a) Find the probability that on any particular day the mail will be delivered between 10 am and 11 am.

(b) Elizabeth leaves home at very nearly the same time each day. If the mail is delivered after this time Elizabeth considers the mail delivery to be 'late'. Elizabeth notices that the mail is delivered late 20% of the time.

Find the latest time that the mail can be delivered without being late.

QUESTION FOUR

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John buys some pizzas to feed their friends. The pizzas are considered underweight if they weigh less than 300 grams. The weights of the pizzas are independent and normally distributed with a mean of 320 grams and a standard deviation of 20 grams.

What is the probability that two pizzas bought for dinner are **both** underweight?

QUESTION FIVE

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As a present Elizabeth and John received a box of imported white chocolates. It is known that the 12 chocolates in the box are independently selected. The individual chocolates have weights that are normally distributed with a mean of 64 grams and a standard deviation of 3 grams. On the side of the box it states that the 12 chocolates in the box have a total net weight of 750 grams.

What is the probability that the 12 chocolates have a total net weight of at least 750 grams?

QUESTION SIX

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Elizabeth and John are to build a boundary fence requiring 130 fence palings. A timber supply firm states that 10% of its fence palings are bent and bent palings should not be used for fencing. The fence palings are all being sold at a cheaper price because of this.

Elizabeth and John buy 150 fence palings for their fence from this timber supply firm. Assume that the fence palings are randomly selected from a large stack of palings.

(a) If the random variable X represents the number of non-bent fence palings in a random sample of 150 palings chosen from the stack, state the name of the distribution that X will have and the value of each parameter. Fully justify why X has this distribution.

(b) One method for calculating related probabilities would be to use an approximating distribution. State, with justification, which approximating distribution would be appropriate to use?

(c) Calculate the probability that Elizabeth and John will have sufficient quality fence palings for their fence (ie at least 130 non-bent fence palings.)

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**Extra paper for continuation of answers if required.
Clearly number the question.**

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Question number