

**Mid-term examination in ST0101 Probability with applications**

Thursday 11 October 2007 12:15–14:00

Permitted aids: Any written and printed material. One calculator.

Mark one answer for each problem on the form overleaf. You will score one point for each right answer and zero points for each wrong answer. Multiple answers will score zero.

NB: There is text on both sides of the sheet. All problems have five alternative answers.

**Problem 1.** A lab found 8, 11, 7, 13, 10, 11, 7 and 9 bacteria of a certain kind in cultures from eight persons. What is the sample standard deviation of the number of bacteria? You may use the fact that  $\sum(x_i - \bar{x})^2 = 32$ , where the  $x_i$  are the data and  $\bar{x}$  is the mean of them.

- (a) 2.00   (b) 2.34   (c) 3.03   (d) 2.14   (e) 2.58

**Problem 2.** A container contains three white and three black balls. We draw two balls without replacement. What is the probability that the two balls have the same colour?

- (a) 1/2   (b) 4/15   (c) 1/3   (d) 7/15   (e) 2/5

**Problem 3.** 25 % of the potato fields in a county are contaminated with a disease. A lab tests the potatoes for disease, and the test is positive for 99% of the contaminated fields. However, it is also positive for 17% of the fields that are not contaminated. What is the unconditional probability that the test is positive for a randomly chosen field?

- (a) 0.785   (b) 0.580   (c) 0.375   (d) 0.356   (e) 0.500

**Problem 4.** What is the conditional probability that a field is contaminated given that the test is positive for the field (see the previous problem)?

- (a) 0.43   (b) 0.50   (c) 0.66   (d) 0.32   (e) 0.70

**Problem 5.** In a chemistry lab two experiments are performed,  $A$  and  $B$ . The probability that  $A$  will succeed is 0.92, the probability that both will succeed is 0.48, and the probability that at least one of them will succeed is 0.97. What is the probability that  $B$  will succeed?

- (a) 0.45   (b) 0.05   (c) 0.52   (d) 0.44   (e) 0.53

**Problem 6.** Ragna is at a tombola. 100 tickets are sold, and the prizes are two cakes. Ragna buys ten tickets. What is the probability that she doesn't win any cake?

- (a) 0.75   (b) 0.83   (c) 0.77   (d) 0.79   (e) 0.81

**Problem 7.** For the random variables  $X$  and  $Y$  we have  $\text{Var} Y = 4$ ,  $\text{Var}(X + Y) = 3$  and  $\text{Cov}(X, Y) = -2$ . What is  $\text{Var} X$ ?

- (a) 5   (b) 1   (c) 3   (d) 4   (e) 2

**Problem 8.** A class is assembling a team consisting of two girls and two boys for a maths competition, and there are eight boys and five girls who want to participate. The number of possible teams are

- (a) 1120   (b) 38   (c) 1600   (d) 280   (e) 76

**Problem 9.** A random variable  $X$  has expected value (mean) 8 and standard deviation 2. What is the expected value (mean) of  $X^2$ ?

- (a) 60   (b) 72   (c) 56   (d) 68   (e) 64

**Problem 10.** The probability distribution of the discrete random variable  $X$  is given by  $P(X = x) = (x + 1)/10$  for  $x = 0, 1, 2, 3$ . What is  $\text{Var } X$ ?

- (a) 1.2   (b) 1.0   (c) 1.1   (d) 1.3   (e) 0.9

**Problem 11.** The probability density of a continuous random variable  $X$  is given by  $f(x) = x/8$  when  $0 < x < 4$  and  $f(x) = 0$  for all other values of  $x$ . What is the cumulative distribution function for  $X$  when  $0 < x < 4$ ?

- (a)  $x^2/4$    (b)  $x/8$    (c)  $x^2/16$    (d)  $1/8$    (e)  $x/4$

**Problem 12.** Let  $X$  have the same probability density as in the previous problem. What is the expected value (mean) of  $X$ ?

- (a)  $9/4$    (b)  $8/3$    (c) 2   (d) 3   (e)  $5/2$

Problem	a	b	c	d	e
1					
2					
3					
4					
5					
6					
7					
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9					
10					
11					
12					

Studentnummer	Student number
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Studieprogram	Study program
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Inspektør	Inspector
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