Mid-term examination in ST0101 Probability with applications
Thursday 12 October 2006 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. If a day is cloudy, then the probability that the day is rainy is 0.3. The probability that a day is cloudy is 0.2. What is the probability that a day is rainy and cloudy?

(a) 0.06 **(b)** 0.1 **(c)** 0.5 **(d)** 2/3 **(e)** 0.3

Problem 2. The probability distribution of a discrete random variable X is given by $P(X = x) = (5 - x)/10$ for $x = 1, 2, 3, 4$. What is $\operatorname{Var} X$?

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

Problem 3. In a chemistry lab two experiments are performed, A and B. The probability that A succeeds is 0.8, and the probability that B succeeds is 0.6. The probability that both succeed is 0.5. What is the probability that none of the two experiments succeed?

(a) 0.2 **(b)** 0.5 **(c)** 0.1 **(d)** 0.3 **(e)** 0.4

Problem 4. What is the probability of throwing 14 with 3 dice?

(a) 9/128 **(b)** 1/54 **(c)** 1/18 **(d)** 1/9 **(e)** 15/216

Problem 5. A continuous random variable X has cumulative distribution function F given by $F(x) = 0$ for $x < 0$, $F(x) = x^3$ for $0 \leq x < 1$ and $F(x) = 1$ for $x \geq 1$. What is $P(1/4 < X < 1/2)$?

(a) 12/1024 **(b)** 7/64 **(c)** 15/512 **(d)** 9/32 **(e)** 9/16

Problem 6. Let X have the same probability distribution as in the previous problem. What is the mean (expected value) of X?

(a) 1 **(b)** 0.75 **(c)** 0.25 **(d)** 0.2 **(e)** 0.8

Problem 7. The weights of five newly hatched pythons are 32, 29, 35, 30 and 33 g. What is the mean of the weights?

(a) 31.8 g **(b)** 32.0 g **(c)** 32.4 g **(d)** 31.6 g **(e)** 32.2 g

Problem 8. Approximately what is the sample standard deviation of the weights of the previous problem?

(a) 2.6 g **(b)** 2.8 g **(c)** 2.2 g **(d)** 2.0 g **(e)** 2.4 g

Problem 9. For the random variables X and Y we have $EX = EY = 1/2$, $E(X^2) = E(Y^2) = 1/3$ and $E(XY) = 2/9$. What is the correlation coefficient $\operatorname{Corr}(X, Y)$ of X and Y?

(a) 1/3 **(b)** 2/3 **(c)** $-2/3$ **(d)** 0 **(e)** $-1/3$

Problem 10. Let A denote the event that a polygraph reading is positive (indicating that the subject is lying), and let L denote the event that the subject is lying. Studies show that $P(A \mid L) = 0.88$ and $P(\overline{A} \mid \overline{L}) = 0.86$. Suppose that $P(L) = 0.01$. Approximately what is the conditional probability that a subject is telling the truth given that the polygraph reading is positive?

(a) 0.12 **(b)** 0.14 **(c)** 0.16 **(d)** 0.94 **(e)** 0.78

Problem 11. The probability that a person's eyes are shut on a photo is 0.01. Whether a person's eyes are shut are independent of whether another person's eyes are shut. A group photo of 25 persons is taken. Approximately what is the probability that all have their eyes open?

(a) 0.88 **(b)** 0.78 **(c)** 0.98 **(d)** 0.58 **(e)** 0.68

Problem 12. An urn contains tree blue and two green balls. We draw two balls without replacement. What is the probability that the two balls have different colour?

(a) 0.5 **(b)** 0.6 **(c)** 0.7 **(d)** 0.48 **(e)** 7/15

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

Studentnummer / Student number

Studieprogram / Study program

Inspektør / Inspector