Answer sheet - to be handed in

MATH10282 Introduction to Statistics
Class Test, 27th March 2017
Time allowed: 40 minutes

University approved calculators permitted.

This is the class test for Introduction to Statistics. It counts for 10% of the module mark. Answer **all** questions. The total number of marks on the paper is 20.

For each question, mark **one** of the possible answer boxes with an 'X'.

You may wish to use the paper provided for rough work.

Full name:

Student ID:

Tutorial group: ☐ Mon 10am ☐ Tue 3pm ☐ Thu 9am ☐ Thu 2pm

Q	***Mark <u>one</u> answer per question with an 'X'***						
1.	(a) ☐	(b) ☐	(c) ☐	(d) ☐	(e) ☐	[1]	[ ]
2.	(a) ☐	(b) ☐	(c) ☐	(d) ☐	(e) ☐	[3]	[ ]
3.	(a) ☐	(b) ☐	(c) ☐	(d) ☐	(e) ☐	[2]	[ ]
4.	(a) ☐	(b) ☐	(c) ☐	(d) ☐	(e) ☐	[1]	[ ]
5.	(a) ☐	(b) ☐	(c) ☐	(d) ☐	(e) ☐	[3]	[ ]
6.	(a) ☐	(b) ☐	(c) ☐	(d) ☐	(e) ☐	[2]	[ ]
7.	(a) ☐	(b) ☐	(c) ☐	(d) ☐	(e) ☐	[2]	[ ]
8.	(a) ☐	(b) ☐	(c) ☐	(d) ☐	(e) ☐	[2]	[ ]
9.	(a) ☐	(b) ☐	(c) ☐	(d) ☐		[2]	[ ]
10.	(a) ☐	(b) ☐	(c) ☐	(d) ☐		[2]	[ ]

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Question sheet - do not hand in

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1. Consider the following data:

   2.92, 4.20, 5.26, 7.98, 8.23, 8.84, 9.79, 10.94, 15.95, 16.05

   To 2 d.p., what is the sample mean?

   (a) 9.01 (b) 9.02 (c) 9.03 (d) 9.04 (e) 9.05

   [1 mark]

2. Consider the following data, which is the same as in Question 1:

   2.92, 4.20, 5.26, 7.98, 8.23, 8.84, 9.79, 10.94, 15.95, 16.05

   To 2 d.p., what is the sample variance?

   (a) 17.80 (b) 19.78 (c) 23.92 (d) 25.71 (e) 28.81

   [3 marks]

3. Consider the following data, which is the same as in Question 1:

   2.92, 4.20, 5.26, 7.98, 8.23, 8.84, 9.79, 10.94, 15.95, 16.05

   To 3 d.p., what is the sample lower quartile? Use the main method discussed in lectures to calculate the 'Type 6' lower quartile.

   (a) 4.465 (b) 4.601 (c) 4.730 (d) 4.995 (e) 5.101

   [2 marks]

4. Suppose that $X_1, \ldots, X_{10}$ denote a random sample of size $n = 10$ from a $N(11, 6^2)$ distribution. What is the sampling distribution of $\bar{X}$?

   (a) $N(1.1, 3.6)$ (b) $N(11, 3.6)$ (c) $N(110, 60)$ (d) $N(11, 0.6)$ (e) $N(110, 360)$

   [1 mark]

5. Suppose that $X_1, \ldots, X_{10}$ denote a random sample of size $n = 10$ from a $N(11, 6^2)$ distribution. To 3 d.p., what is the probability that $\bar{X} \leq 13.5$?

   Hint: you may use the following table of values for the standard normal c.d.f., $\Phi(z)$.

z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
1.2	0.885	0.887	0.889	0.891	0.893	0.894	0.896	0.898	0.900	0.901
1.3	0.903	0.905	0.907	0.908	0.910	0.911	0.913	0.915	0.916	0.918
1.4	0.919	0.921	0.922	0.924	0.925	0.926	0.928	0.929	0.931	0.932
1.5	0.933	0.934	0.936	0.937	0.938	0.939	0.941	0.942	0.943	0.944

   (a) 0.897 (b) 0.901 (c) 0.906 (d) 0.911 (e) 0.925

   [3 marks]

6. Suppose that $X_1, \ldots, X_{10}$ denote a random sample of size $n = 10$ from a $N(11, 6^2)$ distribution. Let S^2 denote the sample variance. Which of the following statements is true?

   (a) $0.25\, S^2 \sim \chi^2(9)$ (b) $\frac{4}{S^2} \sim \chi^2(9)$ (c) $\frac{3.6}{S^2} \sim \chi^2(10)$

   (d) $0.28\, S^2 \sim \chi^2(10)$ (e) $S^2 \sim \chi^2(9)$

   [2 marks]

7. Suppose that $X_1, \ldots, X_{10}$ denote a random sample of size $n = 10$ from a $N(11, 6^2)$ distribution. To 3 d.p., what is the probability that $S \leq 9.713$?

   Hint: You may use the following table, which lists some important quantiles of the $\chi^2(\nu)$ distribution, i.e. the value q such that $P(Y \leq q) = p$, where $Y \sim \chi^2(\nu)$.

	p				
ν	0.950	0.975	0.990	0.995	0.999
9	16.919	19.023	21.666	23.589	27.877
10	18.307	20.483	23.209	25.188	29.588

   (a) 0.950 (b) 0.975 (c) 0.990 (d) 0.995 (e) 0.999

   [2 marks]

8. Suppose that $X_1, \ldots, X_n \sim \text{Po}(\lambda)$ independently with $n \geq 5$, and define the following estimators of λ:

$$\hat{\lambda}_1 = \bar{X}\,, \qquad \hat{\lambda}_2 = \frac{1}{6}(X_1 + 4X_2 + X_3)\,.$$

Which of the following statements is true?

(i) The estimator $\hat{\lambda}_1$ is unbiased for λ.

(ii) The estimator $\hat{\lambda}_2$ is unbiased for λ.

(iii) $\text{Var}(\hat{\lambda}_1) < \text{Var}(\hat{\lambda}_2)$

(iv) cannot say whether $\text{Var}(\hat{\lambda}_1) < \text{Var}(\hat{\lambda}_2)$

(a) none of the above (b) (i) only (c) (i) and (iv) only
(d) (i), (ii) and (iv) only (e) (i), (ii) and (iii) only

[2 marks]

9. Suppose again that $X_1, \ldots, X_n \sim \text{Po}(\lambda)$ independently with $n \geq 5$. Which of the following estimators has variance $\frac{7\lambda}{18}$?

(a) $\bar{X}$ (b) $\frac{1}{3}X_1 + \frac{2}{3}X_2$ (c) $\frac{1}{6}(X_1 + 4X_2 + X_3)$ (d) $\frac{1}{6}(3X_2 + 2X_4 + X_5)$

[2 marks]

10. Suppose that $X_1, \ldots, X_n \sim N(\mu, 2)$ independently, with μ unknown, and that a data set is obtained with $n = 20$ and $\bar{x} = 15.1$. Which of the following is a 95% confidence interval for μ?

(a) (14.48, 15.72) (b) (14.29, 15.91) (c) (14.36, 15.75) (d) (13.86, 16.34)

[2 marks]

[END OF CLASS TEST]