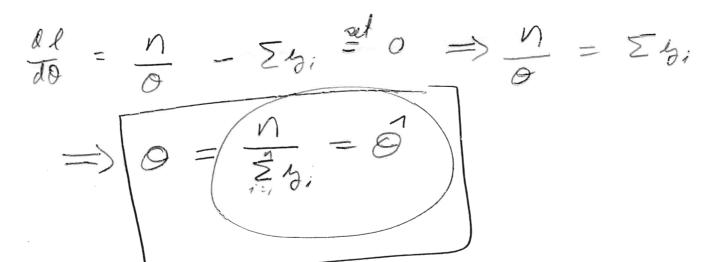
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STA 442/2101 f2014 Quiz 1

Student Number

- 1. (5 points) A random sample of size n was drawn from a distribution with density $f(y) = \theta e^{-\theta y}$ for y > 0, where the parameter $\theta > 0$.
 - (a) Find the maximum likelihood estimator of θ . Show your work. Don't bother wth a second derivative test. Your answer is a symbolic expression. Circle your final answer.



(b) The data values are 4.1, 9.3, 2.2, 4.4. Give the maximum likelihood estimate in numeric form. Your answer is a number. Circle it.

$$\hat{Q} = \frac{4}{20} = \frac{1}{5}$$
Page 1 of 2

2. (5 points) Let **X** be a real $n \times p$ matrix, and let **a** be a real $p \times 1$ column vector. Show that $\mathbf{a}'(\mathbf{X}'\mathbf{X})\mathbf{a} \geq 0$ (that is, $\mathbf{X}'\mathbf{X}$ is non-negative definite). You have a lot more room

2. (5 points) Let X be a real
$$n \times p$$
 matrix, and let a be a real $p \times 1$ that $\mathbf{a}'(\mathbf{X}'\mathbf{X})\mathbf{a} \geq 0$ (that is, $\mathbf{X}'\mathbf{X}$ is non-negative definite). You have than you need.

$$\mathbf{a}'(\mathbf{X}'\mathbf{X})\mathbf{a} = (\mathbf{a}'\mathbf{X}') \times \mathbf{a}$$

$$= (\mathbf{X}\mathbf{a})' \times \mathbf{a} = \sum_{j=1}^{n} \mathbf{Z}_{j}^{2} \geq 0$$

$$\mathbf{a}'' = \mathbf{a}'' \times \mathbf{a} = \sum_{j=1}^{n} \mathbf{Z}_{j}^{2} \geq 0$$