# Stat261 - Spring 2018
## Assignment #3 - due Thursday, February 1, 2018 in class
## Neatly hand write your solutions - marks will be assigned for presentation

1. An experiment was conducted to estimate $\gamma$, the 90th percentile (0.90) of the lifetime distribution of a new type of transistor. The 90th percentile is the value, $\gamma$ such that

$$\mathrm{P}(X \leq \gamma) = 0.90.$$

Ten transistors were tested and the observed lifetimes were:

$$9, 25, 6, 18, 43, 17, 12, 10, 18, 22.$$

Assuming that the lifetimes follow an exponential distribution with mean $\theta$, find the maximum likelihood estimate of $\gamma$, where $\gamma$ satisfies, $.90 = \int_0^\gamma \ f(x;\theta)dx = \int_0^\gamma \frac{1}{\theta}\exp(-x/\theta)\ dx$.

2. Pea plants are classified according to the shape, round (R) or angular (A), and colour, green (G) or yellow (Y), of the peas they produce. According to genetic theory, the four possible plant types, RG, RY, AG, AY have probabilities $\alpha\beta$, $\alpha(1-\beta)$, $(1-\alpha)\beta$, and $(1-\alpha)(1-\beta)$, respectively, with different peas being independent of one another.

The following table shows the observed frequencies of the four types in 100 plants examined:

| Plant Type | RG | RY | AG | AY |
|---|---|---|---|---|
| Observed frequency | 55 | 21 | 19 | 5 |

Find the MLE's of $\alpha$ and $\beta$, and compute the estimated expected frequencies for each possibility under the model. You need not show the second derivative conditions.

3. Suppose that $X_1, X_2, ...X_n$ are independent normal variates with the same variance $\sigma^2$, but with different means,

$$X_i \sim N(\mu b_i, \sigma^2), \text{ for } i = 1, 2, ...n$$

where $b_1, b_2, ...b_n$ are known constants. Find expressions for the MLE of $\mu$ and $\sigma^2$. You need not show the second derivative conditions.