9. (16 pts) Three different IR Sensors were tested to determine differences in maximum detection range against a common target.

a. (12 pts) Using Anova, test the null hypothesis that there was no significant difference between IR Sensor detection ranges at $\alpha = 0.05$ level of significance. (**SHOW ALL WORK**)

IR SENSORS (a_j) (1000 yds)					
Sensor A (a_1)		Sensor B (a_2)		Sensor C (a_3)	
12	144	9	81	7	49
9	81	12	144	9	81
11	121	8	64	6	36
		8	64	6	36
32	1024	37	1369	28	784

unequal sample sizes

$(97)^2 = 9,409 \quad \frac{}{11} = 855.36$

One Way ANOVA formulas:

$$\sum_{j=1}^{k}\sum_{i=1}^{n} y_{ij}^2 = \boxed{901}$$

$$C = \frac{T_{..}^2}{N} = 855.36$$

$T = Data\ total = (97)$
$N = Total\ (\#\ of\ trials) = 11$

$$SStr = \sum_{j=1}^{k}\frac{T_j^2}{n} - C = \text{ or } SStr = \sum_{j=1}^{k}\frac{T_j^2}{n_j} - C =$$

$\boxed{SStr = 24.2197}$

203.15

$\frac{T_j^2}{n} = \frac{3177}{3} = 1059$

$\frac{1024}{3} + \frac{1369}{4} + \frac{784}{4} = 879.5833 - 855.3656$

$$SST = \sum_{j=1}^{k}\sum_{i=1}^{n} y_{ij}^2 - C = \boxed{45.63636}$$

$\sum$ square all individual data

$$SSE = SST - SStr = \cancel{127.1136} \quad \boxed{36.4166}$$

Source	D.F.	Sums of Squares	Mean Squares	Fs	Fα = 0.05	Significant / Not Significant
IR Sensor	2	24.2197	12.10985	4.523523	0.048502	Significant
Exp. Error	8	21.41667	2.677083			
Total	10	116.9167				

b. (4 pts) Estimate the parameters: overall mean (*u*), and factors a_1, a_2, a_3

$u = 8.8181$ $a_1 = 0.8484$

$a_2 = 0.4318$ $a_3 = -1.8181$