```
/* Montgomery 14.2 */
proc import datafile="/home/u63048916/STAT571B/Homework/Homework 7/Q14-2.xlsx"
    dbms=xlsx
    out=nest
    replace;
    getnames=yes;
run;

/* if only operator is random*/
proc mixed data=nest method=type1 CL covtest;
class Machine Operator;
model Finish=Machine;
random Operator(Machine);
lsmeans Machine / alpha=.05 cl diff adjust=tukey;
run;
```

14.2. The surface finish of metal parts made on four machines is being studied. An experiment is conducted in which each machine is run by three different operators and two specimens from each operator are collected and tested. Because of the location of the machines, different operators are used on each machine, and the operators are chosen at random. The data are shown in the following table. Analyze the data and draw conclusions.
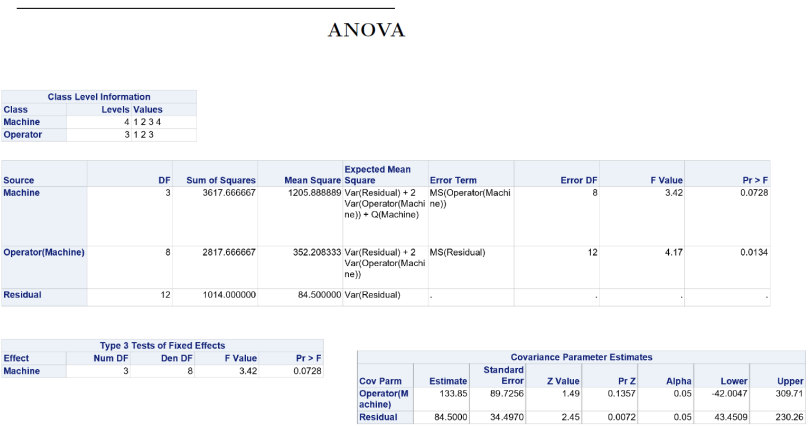
	Machine 1			Machine 2			Machine 3			Machine 4		
Operator	1	2	3	1	2	3	1	2	3	1	2	3
	79	94	46	92	85	76	88	53	46	36	40	62
	62	74	57	99	79	68	75	56	57	53	56	47

3. **Montgomery 14.2**

This is a two factor nested model

$$y_{ijk} = \mu + \tau_i + \beta_{j(i)} + \epsilon_{k(ij)} \begin{cases} i = & 1,2,3,4 \\ j = & 1,2,3 \\ k = & 1,2 \end{cases}$$

ANOVA

Class Level Information

Class	Levels	Values
Machine	4	1 2 3 4
Operator	3	1 2 3

Source	DF	Sum of Squares	Mean Square	Expected Mean Square	Error Term	Error DF	F Value	Pr > F
Machine	3	3617.666667	1205.888889	Var(Residual) + 2 Var(Operator(Machine)) + Q(Machine)	MS(Operator(Machine))	8	3.42	0.0728
Operator(Machine)	8	2817.666667	352.208333	Var(Residual) + 2 Var(Operator(Machine))	MS(Residual)	12	4.17	0.0134
Residual	12	1014.000000	84.500000	Var(Residual)	.	.	.	.

Type 3 Tests of Fixed Effects

Effect	Num DF	Den DF	F Value	Pr > F
Machine	3	8	3.42	0.0728

Covariance Parameter Estimates

Cov Parm	Estimate	Standard Error	Z Value	Pr Z	Alpha	Lower	Upper
Operator(Machine)	133.85	89.7256	1.49	0.1357	0.05	-42.0047	309.71
Residual	84.5000	34.4970	2.45	0.0072	0.05	43.4509	230.26

Need to check assumptions

Figure 14.2.1

The surface finish is near significant at $\alpha = 0.05$ level with P value of 0.0728. There is a significant effect of the Operator using the machine on finish, though, at $\alpha = 0.05$ level with P value of 0.0134.   What does significance mean