ASG - ANAVO - 5 problem statement

One Way Classification:

◆ **Problem 1:**

There are four types of fertilizers used for crop yield improvement. A set of 20 yield values is examined and allocated among four groups (F1, F2, F3, F4) and three soil types (Sandy, Clayey, Loamy) as shown below.

Soil Type / Fertilizer	F1	F2	F3	F4
Sandy	8	6	9	12
Clayey	10	9	13	11
Loamy	7	5	10	14

Is there any significant difference in fertilizers used for different soil types? Use 5% level of significance.

◆ **Problem 2:**

A bank records the transaction values of customers over two days to analyze the consistency in their transaction behavior. The data below shows transaction values (in ₹) for selected Bank IDs on **Day 1** and **Day 2**.

Bank ID	Day 1	Day 2
1000	500	3000
1977	4000	5909

Is there a significant difference in transaction values between Day 1 and Day 2? Test at the 5% level of significance.

◆ **Problem 3:**

Four machines are used in a factory to produce a product. The defect count is recorded under different operators. The data is tabulated below:

Operator / Machine	M1	M2	M3	M4
Operator A	3	4	5	6
Operator B	2	5	3	4
Operator C	4	3	2	5

Is there a significant difference in the performance of machines? Use a 5% significance level.

◆ **Problem 4:**

Three diets (I, II, III) are prescribed to four groups of patients. The weight loss (in kg) after 4 weeks is recorded and given below.

Group / Diet	A	B	C	D
Diet I	4	5	3	6
Diet II	5	6	4	7
Diet III	6	7	5	6

Is there a significant difference among the diets in terms of weight loss? Test at 5% level.

◆ **Problem 5:**

Three brands of detergent are tested across four regions for customer preference scores. The scores are shown below:

Region / Brand	X	Y	Z	W
Brand A	12	14	15	13
Brand B	10	13	11	12
Brand C	14	12	13	15

Is there any significant difference in the customer preference for the detergent brands? Use a 5% level of significance.

Two Way Classification:

◆ **Problem 1:**

Three restaurants each report sales from three different categories over a given period. The sales values (in ₹) for each category are recorded as follows:

Given: Sales in ₹

Restaurants	Sales1	Sales2	Sales3
Restaurant 1	2000	3556	4999
Restaurant 2	4556	3566	4433
Restaurant 3	5466	4580	4654

Discuss the difference between
(i) Restaurants
(ii) Sales categories

◆ **Problem 2:**

The top four cars each participate in three different race categories over a given period. The positions secured (e.g., 1st, 2nd, 3rd) in each race are recorded as follows:

Given: Race placements (1 = 1st place)

Car No.	Race 1	Race 2	Race 3
2332	5	3	1
2435	3	3	2
2489	1	2	1
1355	3	2	1

Discuss the difference between
(i) Car Numbers
(ii) Race Categories

◆ **Problem 3:**

Five students each appear for three different subjects. The marks obtained by each student in these subjects are recorded as follows:

Given: Marks out of 100

Student	Math	Science	English
Riya	85	78	90
Karthik	76	88	79
Meera	92	81	85
Arjun	70	75	80
Sneha	88	90	84

Discuss the difference between
(i) Students
(ii) Subjects

◆ **Problem 4:**

Four machines are operated in three different shifts daily. The number of units produced by each machine during these shifts is recorded below:

Given: Units Produced

Machine No.	Shift 1	Shift 2	Shift 3
M1	120	110	130
M2	100	105	120
M3	140	135	125
M4	130	120	140

Discuss the difference between
(i) Machines
(ii) Shifts

◆ **Problem 5:**

Five teachers attend four professional development workshops. Each teacher rates the workshops on a scale of 1 to 10. The feedback ratings are recorded as follows:

Given: Feedback Ratings (1 = Poor, 10 = Excellent)

Teacher	Workshop 1	Workshop 2	Workshop 3	Workshop 4
Mr. Anand	8	7	9	6
Ms. Rekha	7	8	7	7
Mr. Das	9	8	8	9
Ms. Latha	6	7	6	5
Mr. Ravi	8	9	9	8

Discuss the difference between
(i) Teachers
(ii) Workshops

Method	Supports Two-Way ANOVA	Requires model?	Use for
`scipy.stats.f_oneway()`	❌ No	❌ No	One-way ANOVA only
`statsmodels.formula.api.ols()` + `anova_lm()`	✅ Yes	✅ Yes	Two-way ANOVA (with interaction)