Rubric for Project-4 Total- 10 marks.

The data set below comprises of ratings of construction managers on issues plaguing reconstruction projects post disaster (PDR). In each group (city), there are six different observations from six construction engineers who have been involved in PDR projects over the last many years. For each of the above mentioned issues, you have to perform a one-way ANOVA calculation and test if the data provided in the tables presents a statistically significant difference in the mean rating of the construction engineers between the six different cities.

1. Community Participation:

Rating (scale: 1-10, 1: strongly disagree, 10: strongly agree)						
Cities	Mgr1	Mgr2	Mgr3	Mgr4	Mgr5	Mgr6
Port-au-Prince (Haiti)	y_{11} =3	y_{12} =2	y_{13} =9	y_{14} =8	y_{15} =9	y_{16} =9
Tacloban City	y_{21} =5	y_{22} =9	y_{23} =10	y_{24} =5	y_{25} =8	y_{26} =9
Latur	y_{31} =6	y_{32} =7	y_{33} =10	y_{34} =5	y_{35} =7	y_{36} =8
New Orleans	y_{41} =8	y_{42} =9	y_{43} =9	y_{44} =8	y_{45} =2	y_{46} =8
Kathmandu	y_{51} =3	y_{52} =8	y_{53} =7	y_{54} =10	y_{55} =10	y_{56} =4
Bagh City	y_{61} =2	y_{62} =7	y_{63} =9	y_{64} =10	y_{65} =6	y_{66} =7

2. Funding:

Rating (scale: 1-10, 1: strongly disagree, 10: strongly agree)						
Cities	Mgr1	Mgr2	Mgr3	Mgr4	Mgr5	Mgr6
Port-au-Prince (Haiti)	y_{11} =3	y_{12} =2	y_{13} =9	y_{14} =8	y_{15} =9	y_{16} =7
Tacloban City	y_{21} =5	y_{22} =4	y_{23} =4	y_{24} =5	y_{25} =3	y_{26} =2
Latur	y_{31} =5	y_{32} =2	y_{33} =4	y_{34} =5	y_{35} =1	y_{36} =2
New Orleans	y_{41} =3	y_{42} =1	y_{43} =1	y_{44} =2	y_{45} =6	y_{46} =2
Kathmandu	y_{51} =3	y_{52} =8	y_{53} =7	y_{54} =10	y_{55} =10	y_{56} =4
Bagh City	y_{61} =3	y_{62} =1	y_{63} =9	y_{64} =8	y_{65} =6	y_{66} =7

3. Land Ownership:

Rating (scale: 1-10, 1: strongly disagree, 10: strongly agree)						
Cities	Mgr1	Mgr2	Mgr3	Mgr4	Mgr5	Mgr6
Port-au-Prince (Haiti)	y_{11} =9	y_{12} =9	y_{13} =10	y_{14} =8	y_{15} =7	y_{16} =8
Tacloban City	y_{21} =5	y_{22} =4	y_{23} =4	y_{24} =5	y_{25} =3	y_{26} =2
Latur	y_{31} =4	y_{32} =6	y_{33} =7	y_{34} =2	y_{35} =8	y_{36} =9
New Orleans	y_{41} =3	y_{42} =1	y_{43} =5	y_{44} =2	y_{45} =6	y_{46} =2
Kathmandu	y_{51} =7	y_{52} =4	y_{53} =5	y_{54} =1	y_{55} =2	y_{56} =3
Bagh City	y_{61} =3	y_{62} =2	y_{63} =9	y_{64} =8	y_{65} =6	y_{66} =7

4. Shortage of technical staff:

Rating (scale: 1-10, 1: strongly disagree, 10: strongly agree)						
Cities	Mgr1	Mgr2	Mgr3	Mgr4	Mgr5	Mgr6
Port-au-Prince (Haiti)	y_{11} =6	y_{12} =9	y_{13} =5	y_{14} =5	y_{15} =7	y_{16} =6
Tacloban City	y_{21} =6	y_{22} =4	y_{23} =6	y_{24} =5	y_{25} =7	y_{26} =8
Latur	y_{31} =4	y_{32} =6	y_{33} =7	y_{34} =2	y_{35} =8	y_{36} =9
New Orleans	y_{41} =4	y_{42} =6	y_{43} =6	y_{44} =1	y_{45} =8	y_{46} =9
Kathmandu	y_{51} =10	y_{52} =7	y_{53} =8	y_{54} =1	y_{55} =5	y_{56} =6
Bagh City	y_{61} =3	y_{62} =2	y_{63} =9	y_{64} =8	y_{65} =6	y_{66} =7

This will reveal if the issues plaguing the implementation of PDR projects is affected in an identical manner across the six different cities around the world. Once the issues that are universally relevant have been identified, then the total mean rating score across all cities for a given issue should be computed and a decision on necessary corrective measure should be taken if this grand mean is greater than 5 (on a scale of 10).

Q1. **Assumptions for One Way ANOVA:** State the assumptions of one-way ANOVA. Comment if these assumptions seem reasonable in the context of the PDR data provided here. (0.5 marks)

Q2. **Implementation:** Implement the algorithm prescribed above in Matlab. Specifically, write a matlab script to construct and display the ANOVA table for each of the dataset provided above. (2 marks = 0.5 marks per table)

Recall an ANOVA table comprises of the following data.

Source	d.o.f.†	SS†	MS† $= \frac{SS}{d.o.f.}$	F_{cal}
between groups	$t-1$	SSB	MSB	$\frac{MSB}{MSW}$
within groups	$(\sum_i n_i - t)$	SSW	MSW	
total	$\sum_i n_i - 1$	TSS		

† d.o.f. means degrees of freedom, SS means sum of squares, MS means mean sum of squares.

Q3. **F-distribution:**

(i) Explain how we calculate F_{tab} for one way Anova (hint: see [ch6, pg-79]). (1 mark)

(ii) For the given problem calculate F_{tab} using either matlab or from the F-distribution table corresponding to a level of significance of $\alpha = 0.01$. (1 mark)

Q4. **Hypothesis Testing:**

(i) Explain the concept of hypothesis testing. What are the possible outcomes of the ANOVA test?(1 mark)

(ii) What is the significance of $\alpha = 0.01$? If $\alpha = 0.01$, does that mean that H_0 is true with probability 0.99? (1 mark)

(iii) If there are some issues which could be universally relevant and need immediate redressal across all groups, select and mention them.(1.5 mark)

Important Note:

(a) Both the sections are required to submit file by thursday, 9th June, 5 pm. A penalty of 1 mark will be levied for late submission.

(b) You will only be allotted the complete score for any part above subject to satisfactorily answering the questions asked during your interview by TA's.

(c) 2 marks out of total 10 are for self assesment. But if the examiners feel that the student has not given themselves an accurate score, they would be called for further rounds of interviews before their final score could be accepted.

(d) It is not possible to entertain individual requests from students to be assessed by a specific TA. The grader for each student would be randomly allotted and any change would not be entertained.

References

[ch6] Math of Uncertainity, Module-4