Case Study 1

You are researching which type of fertilizer and planting density produces the greatest crop yield in a field experiment. You assign different plots in a field to a combination of fertilizer type (1, 2, or 3) and planting density (1=low density, 2=high density), and measure the final crop yield in bushels per acre at harvest time. You can use a two-way ANOVA to find out if fertilizer type and planting density have an effect on average crop yield

density	block	fertilizer	yield
1	1	1	177.2286923
2	2	1	177.5500413
1	3	1	176.4084619
2	4	1	177.7036255
1	1	1	177.1254863
2	2	1	176.7783425
1	3	1	176.7463019
2	4	1	177.0611642
1	1	1	176.2749493
2	2	1	177.9672029
1	3	1	176.6012998
2	4	1	177.0305428
1	1	1	177.4795072
2	2	1	176.8741298
1	3	1	176.1143883
2	4	1	176.0083945
1	1	1	176.1083126
2	2	1	178.3574409
1	3	1	177.2624451
2	4	1	176.9188449
1	1	1	176.2390158
2	2	1	176.5730698
1	3	1	176.0392979
2	4	1	176.8179222
1	1	1	176.1605865
2	2	1	177.2264241
1	3	1	175.938533
2	4	1	177.1649367
1	1	1	175.3608396
2	2	1	177.2769957
1	3	1	175.9454438
2	4	1	175.8827796
1	1	2	176.4793409
2	2	2	176.0443421
1	3	2	177.4124617
2	4	2	177.3608182
1	1	2	177.3854992

2	2	2	176.9758077
1	3	2	177.3797787
2	4	2	177.9979951
1	1	2	176.4348626
2	2	2	176.9332651
1	3	2	175.9834802
2	4	2	177.0340927
1	1	2	176.4367624
2	2	2	176.067745
1	3	2	177.1210486
2	4	2	177.1977214
1	1	2	176.6037241
2	2	2	177.2081714
1	3	2	177.1488286
2	4	2	176.8190767
1	1	2	176.9990669
2	2	2	178.1346046
1	3	2	176.429156
2	4	2	176.6683229
1	1	2	176.8958669
2	2	2	177.7794929
1	3	2	176.414495
2	4	2	176.8788977
1	1	2	177.5806831
2	2	2	176.9572689
1	3	2	175.7475456
2	4	2	177.3525951
1	1	3	177.1041864
2	2	3	178.0796352
1	3	3	176.9034221
2	4	3	177.5402842
1	1	3	177.0327097
2	2	3	178.2860419
1	3	3	176.4054102
2	4	3	176.4308301
1	1	3	177.3963306
2	2	3	176.9255758
1	3	3	177.0550458
2	4	3	177.3441639
1	1	3	177.1283675
2	2	3	177.1683022
1	3	3	176.3539406
2	4	3	179.060899
1	1	3	176.3005171
2	2	3	177.5933524

1	3	3	177.1152452
2	4	3	177.7944574
1	1	3	177.0040381
2	2	3	178.0368584
1	3	3	177.7013663
2	4	3	177.6328083
1	1	3	177.6522746
2	2	3	177.1004179
1	3	3	177.187967
2	4	3	177.4052919
1	1	3	178.1416444
2	2	3	177.7106125
1	3	3	177.6872644
2	4	3	177.118176

Required

1. Analyze the data and draw conclusions (Use α 0.05).
2. Rerun the analysis as a one-way ANOVA.
3. Fit the data with a linear regression model.
4. Search for a case study that applies factorial design of experiments in an industrial field. then analyze this case study based on what you had studied .

Note: You may use any software for the analysis (Exel, Minitab, Python, R,etc.)

Case Study 2: Discounts and Expected Prices

Does the frequency with which a supermarket product is offered at a discount affect the price that customers expect to pay for the product? Does the percent reduction also affect this expectation? These questions were examined by researchers in a study conducted on students enrolled in an introductory management course at a large midwestern university. For 10 weeks, 160 subjects received information about the products. The treatment conditions corresponded to the number of promotions (one, three, five, and seven) during this 10-week period, and the percent that the product was discounted (10%, 20%, 30%, and 40%). Ten students were randomly assigned to each of the 4*4 = 16 treatment

Number of promotions	Percent discount	Expected price ($)									
1	40	4.10	4.50	4.47	4.42	4.56	4.69	4.42	4.17	4.31	4.59
1	30	3.57	3.77	3.90	4.49	4.00	4.66	4.48	4.64	4.31	4.43
1	20	4.94	4.59	4.58	4.48	4.55	4.53	4.59	4.66	4.73	5.24
1	10	5.19	4.88	4.78	4.89	4.69	4.96	5.00	4.93	5.10	4.78
3	40	4.07	4.13	4.25	4.23	4.57	4.33	4.17	4.47	4.60	4.02
3	30	4.20	3.94	4.20	3.88	4.35	3.99	4.01	4.22	3.70	4.48
3	20	4.88	4.80	4.46	4.73	3.96	4.42	4.30	4.68	4.45	4.56
3	10	4.90	5.15	4.68	4.98	4.66	4.46	4.70	4.37	4.69	4.97
5	40	3.89	4.18	3.82	4.09	3.94	4.41	4.14	4.15	4.06	3.90
5	30	3.90	3.77	3.86	4.10	4.10	3.81	3.97	3.67	4.05	3.67
5	20	4.11	4.35	4.17	4.11	4.02	4.41	4.48	3.76	4.66	4.44
5	10	4.31	4.36	4.75	4.62	3.74	4.34	4.52	4.37	4.40	4.52
7	40	3.56	3.91	4.05	3.91	4.11	3.61	3.72	3.69	3.79	3.45
7	30	3.45	4.06	3.35	3.67	3.74	3.80	3.90	4.08	3.52	4.03
7	20	3.89	4.45	3.80	4.15	4.41	3.75	3.98	4.07	4.21	4.23
7	10	4.04	4.22	4.39	3.89	4.26	4.41	4.39	4.52	3.87	4.70

<u>Required</u>

1. Analyze the data and draw conclusions (Use α 0.05).
2. Rerun the analysis as a one-way ANOVA.
3. Fit the data with a linear regression model.
4. Search for a case study that applies factorial design of experiments in an industrial field. Then analyze this case study based on what you had studied .

<u>**Note:**</u> You may use any software for the analysis (Exel, Minitab, Python, R,etc.)

Case Study 3

In the automobile industry, three quality inspectors (A, B, C) measure the breaking strength of car seat fabric and the management wants to test for a difference between their measurements by comparing means.

A	B	C
11.3	9.98	10.58
10.62	8.68	9.46
10.36	11.39	10.15
10.23	9.16	10.39
10.42	9.64	9.71
12.64	8.49	9.48
8.75	9.69	10.74
10.49	11.14	10.16
10.33	9.02	11
10.04	9.47	12.54
10.12	10.78	9.88
9.89	9.78	10.1
10.31	10.1	8.85
10.46	10.27	12.52
9.69	10.01	10.74
9.29	9.01	9.19
10.79	9.78	10.08
10.15	9.99	10.51
8.83	9.27	11.42

8.47	10.41	12.12
9.55	9.42	10.16
11.03	9.27	12.06
9.74	8.15	9.49
11.21	9.69	11.05
11.04	10.63	8.53

Required

1. Analyze the data and draw conclusions (Use α 0.05).
2. Fit the data with a linear regression model.
3. Search for two case studies that apply the factorial design of experiments in an industrial field. Then analyze this case study based on what you had studied.

Note: You may use any software for the analysis (Exel, Minitab, Python, R,etc.)