HW9

Question 1.
Hint**:**

- See pages L-106 and L-107 of the lecture notes for formulas and a similar example.
- Because only treatment c is replicated more than once, its variance 42.72 is automatically the MSE with 3-1=2 df.
- Do not forget to ignore “c” when you interpret the fitted effects.

Scientists conducted a half fractional factorial experiment involving factors A, B and C using the generator C=AB. Summary data are given below.

Treatment	**Responses**	**Treatment Sample Size**	**Treatment Sample Mean**	**Treatment Sample Variance**
c	88.8, 94.4, 82.1	3	87.7	42.72
a	69.6	1	69.6	NA
b	32.6	1	32.6	NA
abc	83.2	1	83.2	NA

Notice that the treatments in the table are in (Yates) standard order if we ignore “c”. Yates algorithm produces the following values (p=3, q=1, p - q = 2 cycles):

Treatment	**Means**	**Cycle 1**	**Cycle 2**	**Fitted effect**
c	87.7	157.3	273.1	68.275
a	69.6	115.8	32.5	8.125
b	32.6	-18.1	-41.5	-10.375
abc	83.2	50.6	68.7	17.175

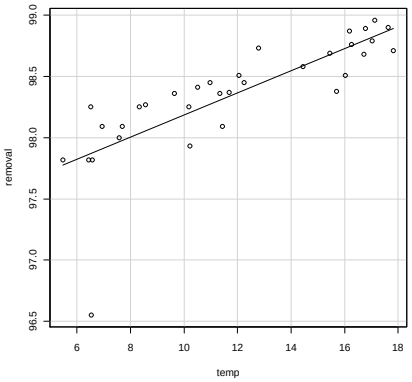
Also note that treatment c was replicated 3 times. This means that we can compute r(α) which we can use to determine which fitted effects are significant. Set the significance level at α=0.05.
A. Perform some calculations to show that r(0.05) = 12.84.
B. The defining relation in this experiment is **I=ABC**. Use this and r(0.05)=12.84 to determine which fitted effects are significant at the α =0.05 level. Just fill in the blanks in the table below to complete this exercise.

Fitted Effect	**Sum of Effects Estimated**	**Significant? Enter YES or NO below.**
8.125		
-10.375		
17.175		

C. If **all** interactions are negligible, which of factors A, B and C are most important?

Question 2. An experiment has 6 factors with 2 levels each. Researchers can only run 1/8 of the 26 = 64 treatments due to costs and time constraints. Let's pick factor A, B, and C as the independent factors. Design 1 chooses the generators as D=A, E=B, E=C. Design 2 picks the generators as D=ABC, E=AB, and F=BC. Explain why design 2 is better than design 1.

Question 3. In biofiltration of wastewater, air discharged from a treatment facility is passed through a damp porous membrane that causes contaminants to dissolve in water and be transformed into harmless products. The accompanying data on x= inlet temperature (°C) and y= removal efficiency (%) was the basis for a scatter plot that appeared in the article "Treatment of Mixed Hydrogen Sulfide and Organic Vapors in a Rock Medium Biofilter"(Water Environment Research, 2001: 426–435). The scatter plot and the summary statistics are given below.



A. Identify the dependent and independent variables.
B. From the scatter plot, do you think the two variables are linearly correlated? Why.