2^k Full and Fractional Factorial Designs

Q.1. A 2^3 factorial experiment is conducted to determine the main effects and interactions among 3 factors (presence/absence) on taste quality for frozen dinners. The following table gives the design, mean, and standard deviation (SD) for the 8 combinations of factor levels. There were 4 replicates per treatment.

(1)	-1	-1	-1	1	1	1		40	2
a	1	-1	-1	-1	-1	1		50	3
b	-1	1	-1	-1	1	-1		42	1
c	-1	-1	1	1	-1	-1		38	2
ab	1	1	-1	1	-1	-1		53	2
ac	1	-1	1	-1	1	-1		47	1
bc	-1	1	1	-1	-1	1		40	3
abc	1	1	1	1	1	1		50	2

p.1.a. Give the +1/-1 levels for the ABC Interaction.

p.1.b. Compute $l_A = \sum_{i=1}^{n} k_i \bar{y}_i$, $\quad SSA = \frac{r}{2^n}(l_A)^2$ $\quad$ where $k_i = \pm 1$ $\quad$ Test H_0: No Factor A effect

l_A = _____ $\quad$ SSA = _____ $\quad$ Test Statistic = _____ $\quad$ Rejection Region: _____

Q.2. A 2^3 factorial experiment is conducted to determine the main effects and interactions among 3 factors (presence/absence) on taste quality for frozen dinners. The following table gives the design, mean, and standard deviation (SD) for the 8 combinations of factor levels. There were 3 replicates per treatment.

Trt	A	B	C	AB	AC	BC	ABC	Mean	SD
(1)	-1	-1	-1	1	1	1		36	4
a	1	-1	-1	-1	-1	1		64	3
b	-1	1	-1	-1	1	-1		28	3
c	-1	-1	1	1	-1	-1		32	2
ab	1	1	-1	1	-1	-1		68	1
ac	1	-1	1	-1	1	-1		72	2
bc	-1	1	1	-1	-1	1		24	3
abc	1	1	1	1	1	1		76	3

p.2.a. Give the +1/-1 levels for the ABC Interaction in the table above.

p.2.b. Compute MSE

p.2.c. Compute $l_A = \sum_{i=1}^{n} k_i \bar{y}_i$, $\quad SSA = \frac{r}{2^n}(l_A)^2$ $\quad$ where $k_i = \pm 1$ $\quad$ Test H_0: No Factor A effect

l_A = _____ $\quad$ SSA = _____ $\quad$ Test Statistic = _____ $\quad$ Rejection Region: _____

Q.3. A 2^3 factorial experiment is conducted to determine the main effects and interactions among 3 factors (presence/absence) on taste quality for frozen dinners. The following table gives the design, mean, and standard deviation (SD) for the 8 combinations of factor levels. There were 3 replicates per treatment.

Trt	A	B	C	AB	AC	BC	ABC	Mean	SD
(1)	-1	-1	-1	1	1	1		40	3
a	1	-1	-1	-1	-1	1		64	2
b	-1	1	-1	-1	1	-1		24	2
c	-1	-1	1	1	-1	-1		36	3
ab	1	1	-1	1	-1	-1		68	1
ac	1	-1	1	-1	1	-1		76	3
bc	-1	1	1	-1	-1	1		20	2
abc	1	1	1	1	1	1		80	2

p.3.a. Give the +1/-1 levels for the ABC Interaction in the table above.

p.3.b. Compute MSE

p.3.c. Compute $l_A = \sum_{i=1}^{n} k_i \bar{y}_i$, $\quad SSA = \dfrac{r}{2^n}\left(l_A\right)^2$ $\qquad$ where $k_i = \pm 1$ $\qquad$ Test H_0: No Factor A effect