MA 60209 Design of Experiments
Assignment No. 4

1. An engineer is interested in the effects of cutting speed (A), tool geometry (B) and cutting angle (C) on the life (in hours) of a machine tool. Two levels of each factor are chosen, and three replicates of a 2^3 design are run. The results are given below. Find estimates of effects and sums of squares. Present results in ANOVA table and draw conclusions.

Treatment Combinations	Replicate		
	I	II	III
(1)	22	31	25
a	32	43	29
b	35	34	50
ab	55	47	46
c	44	45	38
ac	40	37	36
bc	60	50	54
abc	39	41	47

2. Data from two replicates of a 2^4 factorial design are shown below. Find estimates of effects and sums of squares. Present results in ANOVA table and draw conclusions.

Treatment Combinations	Replicate		Treatment Combinations	Replicate	
	I	II		I	II
(1)	190	193	d	198	195
a	174	178	ad	172	176
b	181	185	bd	187	183
ab	183	180	abd	185	186
c	177	178	cd	199	190
ac	181	180	acd	179	175
bc	188	182	bcd	187	184
abc	173	170	abcd	180	180

.

3. The data shown below represent the single replicate of a 2^5 design that is used in an experiment to study the compressive strength of concrete. The factors are mix (A), Time (B), Laboratory (C), Temperature (D) and dyeing time (E). Analyze the data assuming that three-factor and higher interactions are negligible. Find estimates of effects and sums of squares. Present results in ANOVA table and draw conclusions.

Treatment Combinations	Compressive Strength	Treatment Combinations	Compressive Strength
(1)	700	d	1000
a	900	ad	1100
b	3400	bd	3000
ab	5500	abd	6100
c	600	cd	800
ac	1000	acd	1100
bc	3000	bcd	3400
abc	5060	abcd	6000

Treatment Combinations	Compressive Strength	Treatment Combinations	Compressive Strength
e	800	de	1000
ae	1200	ade	1500
be	3500	bde	4000
abe	6200	abde	6500
ce	500	cde	1500
ace	1200	acde	2000
bce	2500	bcde	3400
abce	5500	abcde	6500

4. Find out the main effects and interactions in the following 2^2-factorial experiment and write down the analysis of variance table and do the analysis.

Replicate 1: (1)= 56, a=25, b=60, ab=70	
Replicate 2: (1)=80, a=20, b=50, ab= 60	
Replicate 3: (1)=75, a=14, b=50, ab= 55	
Replicate 4: (1)=75, a=33, b=61, ab=56	