1 Just do it (2.5 points)

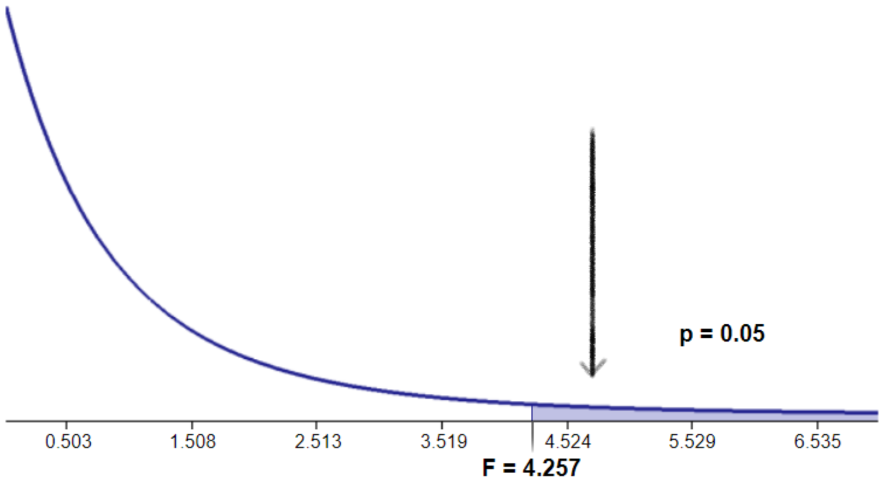
Finally, after a semester doing SMDE you decide to be involved in your first running race, but because you know that some factors can affect your behavior, you decide to do a systematic analysis of your trainings during the previous moths to the race.
One factor that you want to consider is if there is any effect on the time (day hour) when you run. To do so you calculate the time needed to run 10 Km in the morning, evening and afternoon, the time is in minutes.

n	Morning	Evening	Afternoon
1	45	43	42
2	51	42	41
3	46	41	46
4	50	40	50

Is not needed to test the assumptions of the model to use it, but what are the assumptions we must test?
Do you think that the time when you run affects your performance? (we work at 0.05)

	n	**Morning**	**Evening**	**Afternoon**	**Xij-Xj**	**Xij-Xj**	**Xij-Xj**	
	1	45	43	42	9	2,25	7,5625	
	2	51	42	41	9	0,25	14,0625	
	3	46	41	46	4	0,25	1,5625	
	4	50	40	50	4	2,25	27,5625	
mean		**48**	**41,5**	**44,75**	26	5	50,75	
Grand mean		44,75						
		42,25	42,25	0				
						N	12	Observations
SSB		84,5				K	3	Categories
SSW		81,75				G	4	Values by category
MSE		9,083333						
F=		4,651376						
Pr(>F)		0,040998		F(2,9)	4.26	<	F	

REJECT



The time of the day when a runner trains AFFECTS the performance. BTW, this is analyzed on several papers, strongly related with the temperature.

1. Baxter, C.; Reilly, T., Influence of time of day on all-out swimming. British Journal of Sports Medicine 1983, 17 (2), 122-127.

2. Smith, R. S.; Guilleminault, C.; Efron, B., Circadian rhythms and enhanced athletic performance in the national football league. Sleep 1997, 20 (5), 362-365.

3. Drust, B.; Waterhouse, J.; Atkinson, G.; Edwards, B.; Reilly, T., Circadian Rhythms in Sports Performance—an Update. Chronobiology International 2005, 22 (1), 21-44.

4. Waterhouse, J.; Drust, B.; Weinert, D.; Edwards, B.; Gregson, W.; Atkinson, G.; Kao, S.; Aizawa, S.; Reilly, T., The Circadian Rhythm of Core Temperature: Origin and some Implications for Exercise Performance. Chronobiology International 2005, 22 (2), 207-225.
5. El Helou, Nour, et al. "Impact of environmental parameters on marathon running performance." PLoS One 7.5 (2012): e37407.

To believe on this conclusion ee must test on the dataset used.
1. Homocedasticity.
2. Normality.
3. Independence.

2 Apply and explain Yates (2 points)

Explain for what will be used the Yates algorithm and apply it on this table. Describe the results considering that we want to maximize the result.

Experiment	**answer**
1	5
2	6
3	7
4	8
5	7
6	6
7	6
8	8

	Trmt. Comb.	obs.		1	2	3	Estimated Effect	Effect Name
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1	(1)	5		11	26	53	6,625	Mean

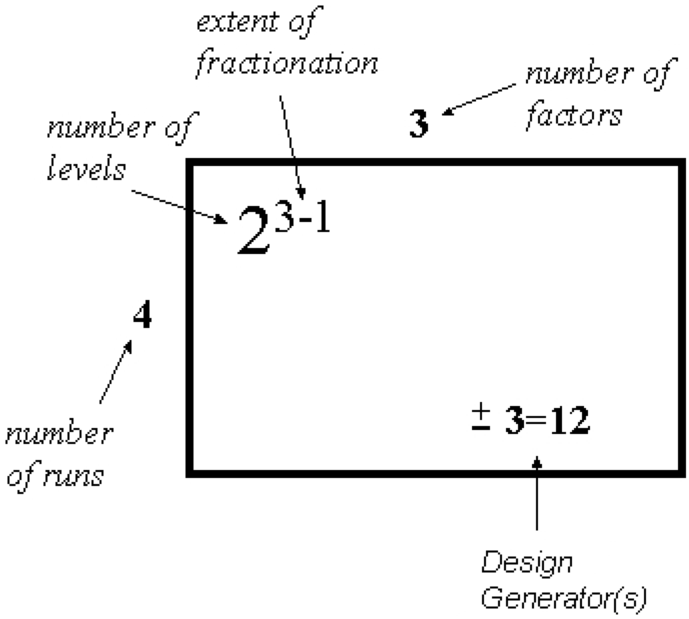
2	a	6	15	27	3	0,75	A
3	b	7	13	2	5	1,25	B
4	ab	8	14	1	3	0,75	AB
5	d	7	1	4	1	0,25	D
6	ad	6	1	1	-1	-0,25	AD
7	bd	6	-1	0	-3	-0,75	BD
8	abd	8	2	3	3	0,75	ABD

Clearly B and A are interesting (main effect and interaction), D main effect seems marginal and its interaction is negative, hence better to avoid D.

3 Reduce the experiments (2.5 points)

On the previous experiment is needed to reduce the number of experiments to 4. Define an experiment that fits this constrain.

We reduce the experiment with a Fractional factorial design. The generator is:



4 Simulate by hand (3 points)

Simulate an activity scanning engine, suppose a delta = 1. We simulate until time = 6. The priority is for the exits.

Id	Time	Event time	Next Arrival	Next Exit	Server state	Queue long
0	0	0	1	-	0	0

The table that defines the arrival time and the service time is.

Element	Arrival time	Service time
1	1	1.5
2	2	2
3	2.5	3
4	3	1
5	6	2

We put in parenthesis, the time when the event will be really processed due to the Activity Scanning approach.

Id	Time	Event time	Next Arrival	Next Exit	Server state	Queue long
0	0	0	1	-	0	0
1	1	1	2	2.5 (3)	1	0
2	2	2	2.5 (3)	2.5 (3)	1	1
3	3	2.5	2.5 (3)	4.5 (5)	1	0
4	3	2.5	3	4.5 (5)	1	1
5	3	3	6	4.5 (5)	1	2
6	4					
7	5	4.5	6	7.5 (8)	1	1
8	6	6	-	7.5 (8)	1	2

Table F The *F* Distribution

$\alpha = .05$

df_D \ df_N	1	2	3	4	5	6	7	8	9	10
1	161.4	199.5	215.7	224.6	230.2	234.0	236.8	238.9	240.5	241.9
2	18.51	19.00	19.16	19.25	19.30	19.33	19.35	19.37	19.38	19.40
3	10.13	9.55	9.28	9.12	9.01	8.94	8.89	8.85	8.81	8.79
4	7.71	6.94	6.59	6.39	6.26	6.16	6.09	6.04	6.00	5.96
5	6.61	5.79	5.41	5.19	5.05	4.95	4.88	4.82	4.77	4.74
6	5.99	5.14	4.76	4.53	4.39	4.28	4.21	4.15	4.10	4.06
7	5.59	4.74	4.35	4.12	3.97	3.87	3.79	3.73	3.68	3.64
8	5.32	4.46	4.07	3.84	3.69	3.58	3.50	3.44	3.39	3.35
9	5.12	4.26	3.86	3.63	3.48	3.37	3.29	3.23	3.18	3.14
10	4.96	4.10	3.71	3.48	3.33	3.22	3.14	3.07	3.02	2.98
11	4.84	3.98	3.59	3.36	3.20	3.09	3.01	2.95	2.90	2.85
12	4.75	3.89	3.49	3.26	3.11	3.00	2.91	2.85	2.80	2.75
13	4.67	3.81	3.41	3.18	3.03	2.92	2.83	2.77	2.71	2.67
14	4.60	3.74	3.34	3.11	2.96	2.85	2.76	2.70	2.65	2.60
15	4.54	3.68	3.29	3.06	2.90	2.79	2.71	2.64	2.59	2.54
16	4.49	3.63	3.24	3.01	2.85	2.74	2.66	2.59	2.54	2.49
17	4.45	3.59	3.20	2.96	2.81	2.70	2.61	2.55	2.49	2.45
18	4.41	3.55	3.16	2.93	2.77	2.66	2.58	2.51	2.46	2.41
19	4.38	3.52	3.13	2.90	2.74	2.63	2.54	2.48	2.42	2.38
20	4.35	3.49	3.10	2.87	2.71	2.60	2.51	2.45	2.39	2.35
21	4.32	3.47	3.07	2.84	2.68	2.57	2.49	2.42	2.37	2.32
22	4.30	3.44	3.05	2.82	2.66	2.55	2.46	2.40	2.34	2.30
23	4.28	3.42	3.03	2.80	2.64	2.53	2.44	2.37	2.32	2.27
24	4.26	3.40	3.01	2.78	2.62	2.51	2.42	2.36	2.30	2.25
25	4.24	3.39	2.99	2.76	2.60	2.49	2.40	2.34	2.28	2.24
26	4.23	3.37	2.98	2.74	2.59	2.47	2.39	2.32	2.27	2.22
27	4.21	3.35	2.96	2.73	2.57	2.46	2.37	2.31	2.25	2.20
28	4.20	3.34	2.95	2.71	2.56	2.45	2.36	2.29	2.24	2.19
29	4.18	3.33	2.93	2.70	2.55	2.43	2.35	2.28	2.22	2.18
30	4.17	3.32	2.92	2.69	2.53	2.42	2.33	2.27	2.21	2.16
40	4.08	3.23	2.84	2.61	2.45	2.34	2.25	2.18	2.12	2.08
60	4.00	3.15	2.76	2.53	2.37	2.25	2.17	2.10	2.04	1.99
120	3.92	3.07	2.68	2.45	2.29	2.17	2.09	2.02	1.96	1.91
∞	3.84	3.00	2.60	2.37	2.21	2.10	2.01	1.94	1.88	1.83