

---

Correct, adequately motivated, and explained answers to problems 1 to 3 give 10 points each. Problems 4 to 6 give 20 points each. Total maximal score is 90 points. The threshold for passing the exam is 40 points. Use the departments paper both for drafting and final answer. the answer to each new problem shall start at the top of a new page. Red pen or pencil is not allowed. Write full name or id on all paper sheets. Approved aids: statistical tables including Mathematical Statistics support sheets, and calculator.

---

1. Within the context of Design of Experiments, explain and exemplify the process of Deduction and Induction. (10p)
2. Within the context of Design of Experiments, explain and exemplify what is meant by a Randomized Experimental Design and why we Randomize. (10p)
3. Within the context of Design of Experiments, explain and exemplify what is meant by Blocking and why we do Blocking. (10p)
4. An experimenter has measured the outcome  $y_A$  and  $y_B$  from two different processes A and B applied in ten different process plants, plant 1 to 10. She obtained the following data:

Plant	$y_A$	$y_B$
1	100	95
2	120	116
3	90	81
4	57	48
5	130	133
6	130	124
7	90	86
8	126	113
9	131	114
10	93	76

She believes that the difference between  $y_A$  and  $y_B$  for each of the plants are independently normally distributed with probability density  $N(\mu, \sigma)$ , but she does not know the expected value  $\mu$  and standard deviation  $\sigma$ . She would like to test if it can be said that the expected value  $\mu$  is different from zero.

Please carry out a statistical test for her at a 5% level of confidence, clearly stating your approach to blocking, your null-hypothesis, and your conclusion. Please further discuss what could be done to validate your assumptions. (20p)

---

Please turn page!

- 
5. An experimenter has applied three different treatments, X, Y, and Z, to laboratory mice with diabetes, measured the life length of each mouse in month, and obtained the following data:

X	Y	C
41	43	48
38	47	46
42	51	52
35	47	50

He would now like to see if there is statistical evidence for a difference in life length due to choice of treatment.

Please propose and carry out an adequate test, clearly stating your choice of test method, your assumptions, your choice of confidence level and your conclusion. (20p)

6. An experimenter has carried out a full  $2^3$  factorial design on factors K, L, and M with two genuinely replicated runs for each factor combination and has drawn up the following table with her results

Factor			Run	
K	L	M	1	2
-	-	-	64	66
+	-	-	79	75
-	+	-	55	63
+	+	-	74	72
-	-	+	55	59
+	-	+	86	90
-	+	+	51	49
+	+	+	84	86

Please calculate main and interaction effects and provide a 95% confidence interval for each effect. Clearly state your assumptions. (20p)

---

Enjoy!