Experimental design (question bank)

1-Mathematical type:

The pot experiment was conducted to study the effect of 5 levels of moisture on growth radius of fungi(mm) and you are given the following information:

1-$\sum t_1=12$ 2-$\sum t_2=14$ 3-$\sum t_3=16$ 4-$\sum t_5=18$ 5-CF=500

6-mean of t1 = 3 compare between treatments using LSDα, if tab.tα =2.8 .df error =30.

Mean of $t_1=\sum t_1/ r$ $3=12/r$ $r=12/3=4$ it means r=4

$CF = G^2/tr$ $500=G^2/5*4$ $500=G^2/20$ $G^2=500*20=10000$

$G^2=\sqrt{10000}$ G=100

$G =\sum t_1 + \sum t_2 + \sum t_3 + \sum t_4 + \sum t_5$

$100=12 +14 +16 + \sum t4 +18$

$=100-60=40$

$\sum t_4= 43$, df error =t(r-1) =5(4-1)=15 MSE =SSE/df error =30/15 =2

$LSD\infty=tab.t *\sqrt{2MSE/r} =2.8*\sqrt{2*2/4} =2.8$. After that we must calculate mean

of treatments then arranging them and calculating all possible differences between means then comparing the results with $LSD\infty$ for testing the significance of them.

Mean of t1=12/4 =3, Mean of t2 =14/4=3.5 ,

Mean of t3= 16/4=4 Mean of t4=40/4 =10 , Mean of t5=18/4=4.5

Means	$t_1=3$	$t_2=3.5$	$t_3=4$	$t_5=4.5$	$t_4=10$	
$t_4=10$	10-3=7*	10-3.5=6.5*	10-4=6*	10-4.5=5.5*	10-10=0	
$t_5=4.5$	1.5n.s	1.0n.s	0.5n.s	0		
$t_3=4$	1.0n.s	0.5n.s	0			
$t_2=3.5$	0.5	0				
$t_1=3$	0					

2-Type four: Schemes:

From the following schemes mention the types of designs:

(b) =LSD

A	B	C	D
B	C	D	A
C	D	A	B
D	A	B	C

A	D	C	B
C	**A**	**B**	**D**
D	**C**	**A**	**B**
			∑∑

(a)=(RCBD)

Type3 :Mathematical type for factorial experiments:

Q[1]: The laboratory experiment was conducted to test the effect of (3) levels of moisture (A factor) and (2) levels of temperature (B factor) on growth radius of fungi (cm) using (4) replicates and you are given the following information.

1- $\sum a_1 b_1 = 12$ $\sum a_1 b_2 = 10$ $\sum a_2 b_1 = 14$ $\sum a_3 b_1 = 13$ $\sum a_2 b_2 = 7$
2- $\sum$ of A factor = 72 3- Total SS = TCSS * 1.2 4- Tab. $t_{0.01} = 2.88$
a- Complete ANOVA table *b- Compare between a_2b_2 and $a_1 b_1$ using LSD $_{0.01}$*

***c- From the following information*:**

	a_1	**a_2**
b_1	**12**	**14**
b_2	**10**	**7**

Calculate (Simple effects, main effects and interaction effect)

Steps for solving the example:

1- $\sum$ of A factor =G= $\sum a_1 b_1 + \sum a_2 b_1 + \sum a_3 b_1 + \sum a_1 b_2 + \sum a_2 b_2 + \sum a_3 b_2$
2- $72=12+14+13+7+10+\sum a_3 b_2$

3- $\sum a_3 b_2 = 72-56=16$

preparing the table contains sum of treatment combinations ,levels of factors and factors.

	a1	a2	a3	
B1	12	14	13	∑ b1 =39
b_2	10	7	16	∑ b2 =33
	$\sum a_1$ =22	$\sum a_2$ =21	$\sum a_3$ =29	

$$CF=(G)^2/abr$$

$$CF=(72)^2/2*3*4=(5184)/24=216$$

$SSA=[(\sum a1)^2+(\sum a2)^2+(\sum a3)^2 \div br]-CF$

$SSA=[(\sum 22)^2+(\sum 21)^2+(\sum 29)^2 \div 2*4]-216$

$SSA=[(484+441+841) \div 8]-216=4.75$

$SSB=[(\sum b1)^2+(\sum b2)^2 \div ar]-CF$

$SSB=[(\sum 39)^2+(\sum 33)^2 \div 3*4]-216=217.5-216=1.5$

$SSAB=\{[(\sum a1b1)^2+\ldots\ldots\ldots\ldots+(\sum a3b2)^2 \div r]-CF\}-SSA-SSB$

$SSAB=\{[(12)^2+\ldots\ldots\ldots\ldots+(16)^2 \div 4]-216\}-4.75-1.5$

SSAB=6.25

TCSS=SSA+SSB+SSAB=4.75+1.5+6.25=12.5

TotalSS=TCSS*1.2

Total ss=12.5*1.2=15 Error SS=TotalSS-SSA-SSB-SSAB

Or Error SS=TotalSS-SSA-SSB-SSAB=Error SS=TotalSS-(SSA+SSB+SSAB)

Error SS=TotalSS-TCSS==15-12.5=2.5

S.O.V.	DF	SS	MS	Calc.F	Tab.F
TC		12.5			
A	a-1=3-1=2	4.75	(4.75/2)=2.38	(2.38/0.14)=17	

B	b-1=2-1=1	1.5	(1.5/1)=1.5	(1.5/0.14)=10.7	
AB	(a-1)(b-1)=(3-1)(2-1)=2	6.25	(6.25/2)=3.13	(3.13/0.14)=22.3	
Error	ab(r-1)=3*2(4-1)=18	2.5	(2.5/18)=0.14		
Total	abr-1=3*2*4-1=23	15			

$LSD_{AB.01}$=tab.t.$_{01}$*√2MSE/r==2.88*√(2*0.14)/4==2.41

Mean of a_1b_1=$\sum a_1\ b_1)/_{r\ =12/4=3}$ Mean of a_2b_2=$(\sum a_2\ b_2)/_{r\ ==7/4=1.75}$

3-1.75=1.7

The difference between them is less than calculated $LSD_{AB.01\ (}$2.41), it means there is no significance difference between them.

	a_1	a_2	Simple effects
b_1	12	14	12-14=-2
b_2	10	7	10-7=3
Simple effects	12-10=2	14-7=7	

From the following information calculate missing value:

A =4	B=5	D=5	E=6	C=3
C=6	D=7	……..	B=8	E=6
D=6	A=7	C=4	D=5	B=3

Steps to solve this example is as follow:

Sum of block which contains missing value =6+7+8+6=27

Sum of treatment (A)which contains missing value=4+ 7=11

G=4+5+5+6+3+6+7+8+6+6+7+4+5+3=75

$$X_{ij}=\frac{rR+tT-G}{(t-1)(r-1)}$$

$$X_{ij}=\frac{3*27+5*11-75}{(5-1)(3-1)}=7.63$$