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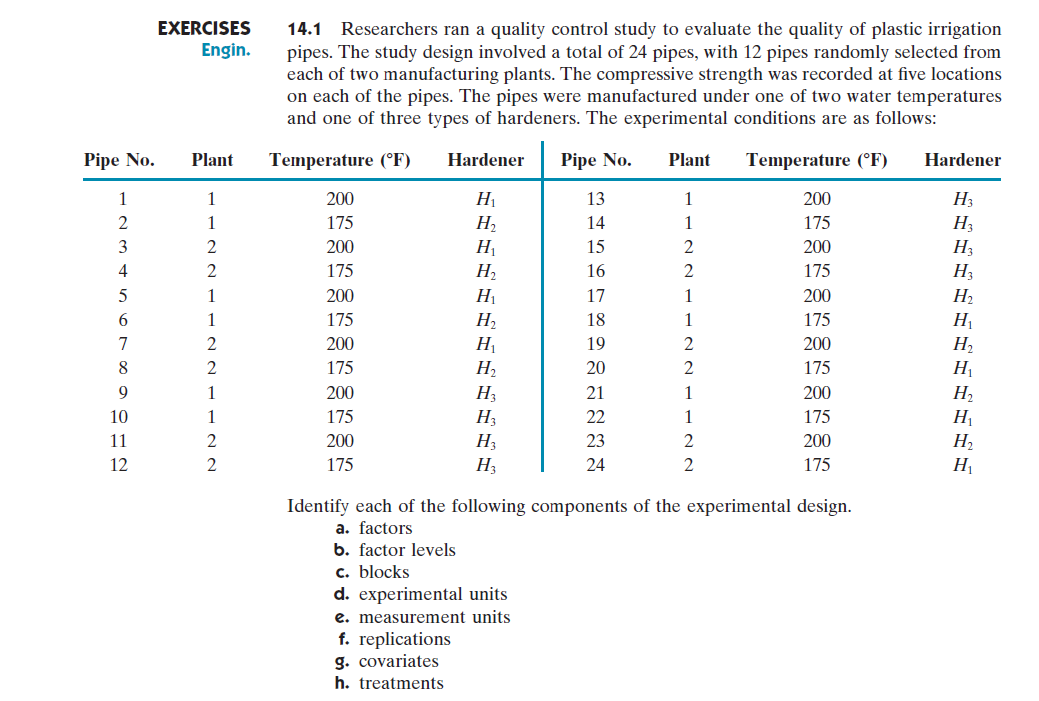
January 17, 2017

STAT 6305

Dr. Zhou

HW 1: 14.1, 14.5, 14.7, 14.16

14.1



1. 3 factors: Plant, Temperature (), Hardener
2. Plant has 2 levels: Plant 1, Plant 2

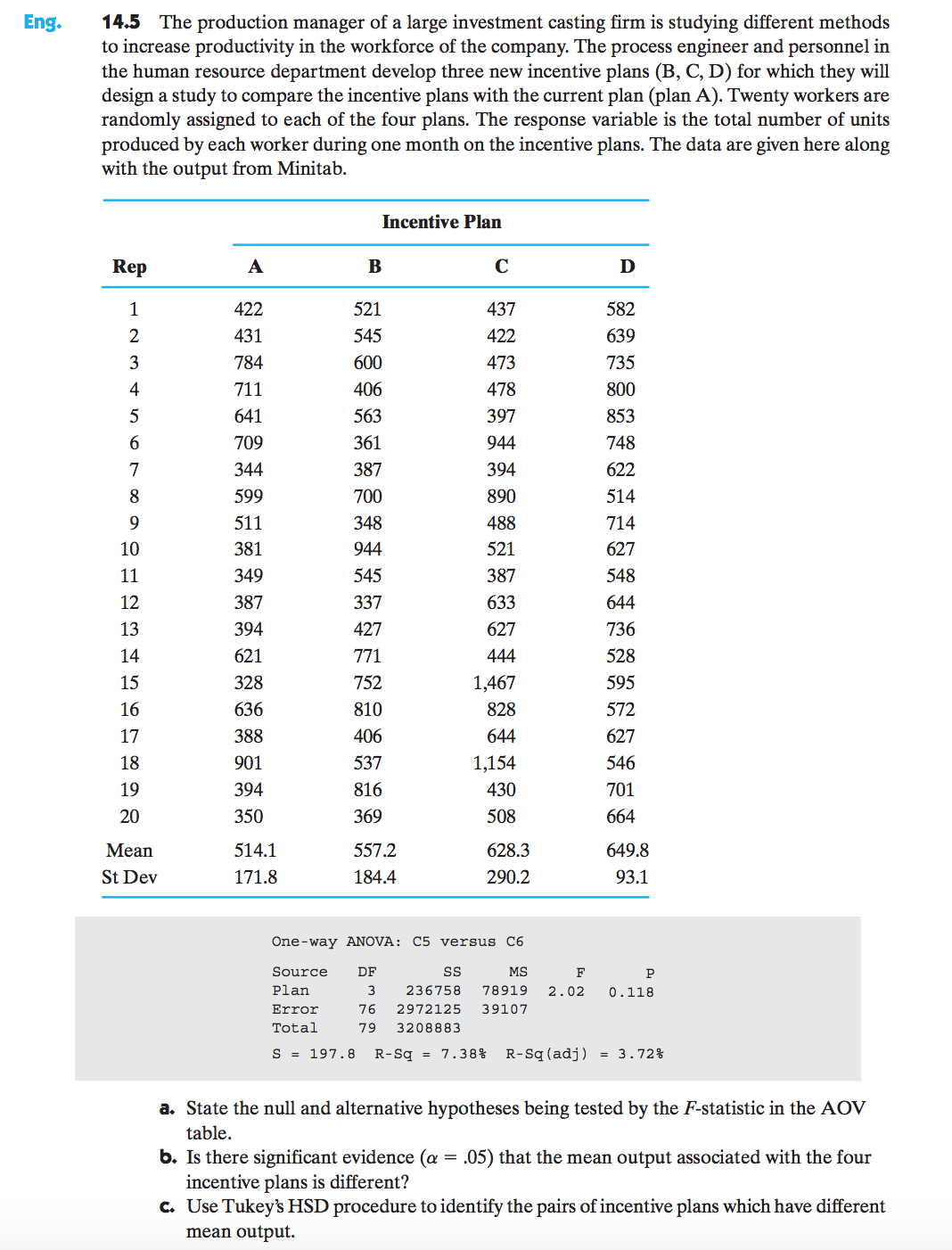
Temperature has 2 factor levels:

Hardener has 3 factor levels:

1. Blocks: none
2. Experimental units: 24 pipes
3. Measurement units: 5 locations measured on each of the 24 pipes totaling 120 measurement units
4. 2 replications: 2 for each combination of plant, temperature, and hardener
5. Covariates: could be thickness, weight, and length of each pipe
6. Treatments: 12 treatments listed in the table below

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Treatment | Plant | Temperature | Hardener | Replications |
|  |  |  |  | pipes 18, 22 |
|  |  |  |  | pipes 1, 5 |
|  |  |  |  | pipes 20, 24 |
|  |  |  |  | pipes 3, 7 |
|  |  |  |  | pipes 2, 6 |
|  |  |  |  | pipes 17, 21 |
|  |  |  |  | pipes 4, 8 |
|  |  |  |  | pipes 19, 23 |
|  |  |  |  | pipes 10, 14 |
|  |  |  |  | pipes 9, 13 |
|  |  |  |  | pipes 12, 16 |
|  |  |  |  | pipes 11, 15 |

14.5



1. Hypotheses being tested:

1. No, there is not significant evidence that at least one is different from the others since the -value .
2. Use Fisher’s LSD procedure to identify the pairs of incentive plans which have different mean output.

# given information about the experiment

n <- 20

alpha <- 0.05

# point estimates of the means

incentive.means <- c(514.1, 557.2, 628.3, 649.8)

# from ANOVA output

MSE <- 39107

df.errors <- 76

# Fisher's LSD procedure

sd.errors <- sqrt(MSE)

t.value <- qt(alpha/2, df.errors, lower.tail = FALSE)

LSD <- t.value\*sd.errors\*sqrt(2/n)

[1] "LSD = 124.550421"

diffCombn.matrix <- combn(incentive.means, 2)

means.diff <- diffCombn.matrix[2,] - diffCombn.matrix[1,]

[1] "Pairs to subtract listed for each possible combination by column:"

[,1] [,2] [,3] [,4] [,5] [,6]

[1,] 514.1 514.1 514.1 557.2 557.2 628.3

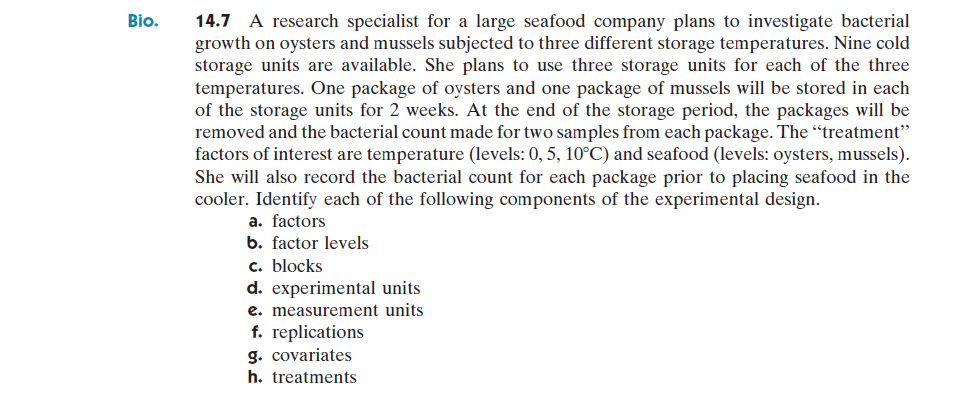
[2,] 557.2 628.3 649.8 628.3 649.8 649.8

[1] "Differences for each pair in relative order to the matrix above:"

[1] 43.1 114.2 135.7 71.1 92.6 21.5

We see that only the difference between plan d and plan a, , is larger than the LSD, . But, since was not rejected in part b, the LSD procedure would not be performed. If we ignored the result of the hypothesis test, the LSD procedure would imply that there is a significant difference between plans A and D.

14.7

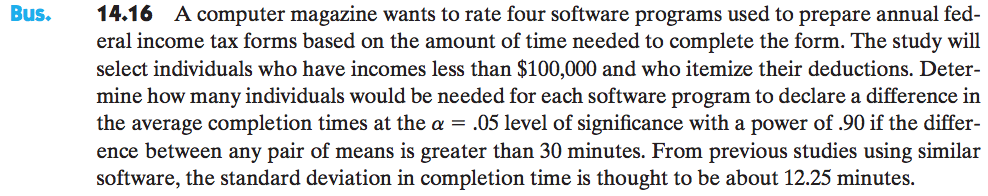


1. 2 factors: temperature, seafood
2. Temperature has 3 factor levels:

Seafood has 2 factor levels: oysters, mussels

1. Blocks: none
2. Experimental units: the package of oysters and package of mussels in each of the 9 storage containers
3. Measurement units: the 2 samples taken from each package, totaling 36 measurement units
4. 3 Replications: Each treatment will be applied in three different storage containers
5. Covariates: the bacterial count in each package prior to performing the experiment, the weight of each package of seafood, number of oysters and mussels in each package
6. 6 treatments: (oyster, 0), (oyster, 5), (oyster 10), (mussel, 0), (mussel, 5), (mussel, 10)

14.16



Given information:

The desired power is . We first obtain the parameters to use in Table 14 from the textbook,

and,

By trial and error, we get the following table,

|  |  |  |  |
| --- | --- | --- | --- |
|  |  |  |  |
| 3 | 8 | 1.50 | 0.48 |
| 7 | 24 | 2.29 | 0.97 |
| 5 | 16 | 1.94 | 0.84 |
| 6 | 20 | 2.12 | 0.90 |

## Alternative method: calculating the power table values using R

# values of replications to test

r <-c(3, 7, 5, 6)

# degrees of freedom for F-dist

v.1 <- t-1

v.2 <- t\*(r-1)

df.1 <- v.1

df.2 <- v.2

# We use the non-centrality parameter of the F-distribution instead of the psi parameter of the book

ncp <- r\*D^2/(2\*sd^2)

F.alpha <- qf(1-alpha, df.1, df.2)

# The power is P(F > F(alpha, t−1,t(r−1),ncp))

power <- 1- pf(F.alpha, df.1, df.2, ncp = ncp)

# Form the table as a data.frame

phi.value <- sqrt(ncp)

table.power <- data.frame(r, v.2, phi.value, power)

r v.2 ncp power

3 8 8.996252 0.4869220

7 24 20.991254 0.9567155

5 16 14.993753 0.8301800

6 20 17.992503 0.9120138

From the chart above, we see that with a minimum of 6 replications the desired power of the test, , will be most closely attained.