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**Grade** 5.0 out of 5.0 (100%)

**Question 1**

Correct

Mark 1.0 out of 1.0

A study compared weight loss among 5 different diet programs. A total sample size of 25 people was studied (5 people in each program) using one-way analysis of variance.

What are the numerator and denominator degrees of freedom for the F-test?

Select one:

- ☐ a. 5 for numerator and 25 for denominator.
- ☐ b. 5 for numerator and 24 for denominator.
- ☒ c. 4 for numerator and 20 for denominator. ✓
- ☐ d. None of the above

Your answer is correct.

The F-test has degrees of freedom equals to  $\frac{k-1}{n-k}$ , where  $k$  is the number of factor levels and  $n$  is the total number of observations.

The correct answer is: 4 for numerator and 20 for denominator.

**Question 2**

Correct

Mark 1.0 out of 1.0

Twenty students were randomly assigned to one of four exercise programs (5 students in each program), and the mean weight loss for the four programs were compared using one-way analysis of variance. The overall mean square error (MS Error) was 40. The mean weight loss for the first program was  $\bar{x}_1 = 7$  pounds.

What are the degrees of freedom for the  $t$  multiplier for a confidence interval for  $\mu_1$ , the population mean weight loss for the first program?

Select one:

- ☐ a. 3
- ☐ b. 15
- ☒ c. 16 ✓
- ☐ d. 20

Your answer is correct.

The degrees of freedom for the  $t$  multiplier for a confidence interval for  $\mu_1$  equals to  $n - p = 20 - 4 = 16$ .

The correct answer is: 16

**Question 3**

Correct

Mark 1.0 out of 1.0

In an experiment to compare eight varieties of oats, the growing area was heterogeneous and so was grouped into five blocks. Each variety was sown once within each block and the yield in grams per 16-ft row was recorded. Data from Anderson and Bancroft (1952) are as shown below.

```
> library(faraway)
> data(oatvar, package = "faraway")
      block
variety  I  II III  IV  V
1  296 357 340 331 348
2  402 390 431 340 320
3  437 334 426 320 296
4  303 319 310 260 242
5  469 405 442 487 394
6  345 342 358 300 308
7  324 339 357 352 220
8  488 374 401 338 320
```

Two models are created with their ANOVA outputs shown below.

```
> lmod <- lm(yield ~ block + variety, oatvar)
> anova(lmod)
```

Analysis of Variance Table

Response: yield

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
block	4	33396	8349	6.24	0.001
variety	7	77524	11075	8.28	1.8e-05
Residuals	28	37433	1337		

```
> anova(lm(yield ~ block, oatvar))
```

Analysis of Variance Table

Response: yield

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
block	4	33396	8349	2.54	0.057
Residuals	35	114957	3284		

To test the treatment effect after accounting for the blocking factor which p-value above should we use?

Select one:

- ☐ a. 0.001
- ☒ b. 1.8e-05 ✓
- ☐ c. 0.057
- ☐ d. None of the above

Your answer is correct.

The first ANOVA table corresponds to a sequential testing of models, here corresponding to the sequence:

$y \sim 1$

$y \sim \text{block}$

$y \sim \text{block} + \text{variety}$

So here the  $p$ -value 0.001 corresponds to a comparison of the first two models in this list, while the  $p$ -value of 1.8e-05 corresponds to the test comparing the second two. As the treatment effect we are interested in, is the effect of variety of oats on the yield, we firstly account for the blocking factor and then check the significance of variety. So we need to choose  $p$ -value 1.8e-05, which suggests that there are significant differences between the mean yield for each variety, once we have accounted for differences between the heterogeneous blocks.

The correct answer is: 1.8e-05

**Question 4**

Correct

Mark 1.0 out of 1.0

Which of these situations could be analysed with a one-way analysis of variance?

Select one:

- ☐ a. The relationship between gender (male or female) and opinion about the death penalty (favor, oppose, uncertain)
- ☐ b. The relationship between weight and height for 12-year old girls
- ☒ c. A comparison of four different age groups with regard to mean hours of watching television per day ✓
- ☐ d. A comparison of four different age groups with regard to proportion that opposes legalization of marijuana

Your answer is correct.

The analysis of variance (ANOVA) model is a method of testing whether the mean responses at different levels of a categorical predictor are all equal.

The correct answer is: A comparison of four different age groups with regard to mean hours of watching television per day

**Question 5**

Correct

Mark 1.0 out of 1.0

12 corn plants were randomly assigned to one of four plots of land (3 plants in each plot), and the mean heights of the plants plots were compared for the four plots using one-way analysis of variance. The mean square error (MS Error) was 20. The average height of corn plants from the first plot was 60 inches.

What is the standard error of the sample mean height of corn plants grown in the first plot ( $\bar{x}_1$ )?

Select one:

- ☐ a. 4.47
- ☐ b. 1.73
- ☒ c. 2.58 ✓
- ☐ d. None of the above

Your answer is correct.

The standard error of  $\mu_1$  (the first level mean) equals to  
$$\sqrt{MSE/n_1} = \sqrt{20/3} = 2.58$$

The correct answer is: 2.58

