STEG220 solved problems, quizzes

suppose that we are interested in the burning rate of a gas fuel used to power heating system.

- Now burning rate is a random variable that can be described by a probability distribution.
- Suppose that our interest focuses on the variance burning rate.

deciding whether or not the variance burning rate is 120 centimeters per minute, then when you want to find the type 2 error it has to be made for a:

a.
standard deviation of 128 cm per minute for example

b.
variance of 128 cm per minute for example

c.
variance of 120 cm per minute for example with 95% CI

d.
mean of 128 cm per minute for example

the significance level is also another representation of:

a.
the power of statistics

b.
type two error

c.
type one error

the power of statistical test is computed by:

a.

it is equal to alpha

b.
calculating 1-Beta factor

c.
it is equal to beta

d.
calculating beta minus alpha

A textile fiber manufacturer is investigating a new
drapery yarn, which the company claims has a mean thread
elongation of 14 kilograms with a standard deviation of 0.5 kilograms.
The company wishes to test the hypothesis H0: μ = 14
against H1: μ no equal to 14, using a random sample of four specimens
1. What is the type I error probability if the critical Region is defined as 14.5< x < 13.5 . kilograms?
2.Find β for the case in which the true mean elongation is 14.25 kilograms

Z1<-2 and Z2>2, then alpha= 0.02275+0.02275= 0.0455

For beta z1=-5, z2 = -1, Beta=P(Z<-1) -P(Z<-5)= 0.15866-0=0.15866

A textile fiber manufacturer is investigating a new
drapery yarn, which the company claims has a mean thread
elongation of 12 kilograms with a standard deviation of 0.5 kilograms.
The company wishes to test the hypothesis H0: μ = 12
against H1: μ no equal to 12, using a random sample of four specimens
1. What is the type I error probability if the critical Region is defined as 12.5< x < 11 5 . kilograms?
2. Find β for the case in which the true mean elongation is 11.25 kilograms

**11-3.** An article in *Concrete Research* ["Near Surface Characteristics of Concrete: Intrinsic Permeability" (1989, Vol. 41)] presented data on compressive strength $x$ and intrinsic permeability $y$ of various concrete mixes and cures. Summary quantities are $n = 14$, $\sum y_i = 572$, $\sum y_i^2 = 23{,}530$, $\sum x_i = 43$, $\sum x_i^2 = 157.42$, and $\sum x_i y_i = 1697.80$. Assume that the two variables are related according to the simple linear regression model.

(a) Calculate the least squares estimates of the slope and intercept. Estimate $\sigma^2$. Graph the regression line.

(b) Use the equation of the fitted line to predict what permeability would be observed when the compressive strength is $x = 4.3$.

(c) Give a point estimate of the mean permeability when compressive strength is $x = 3.7$.

(d) Suppose that the observed value of permeability at $x = 3.7$ is $y = 46.1$. Calculate the value of the corresponding residual.

Solution:

a) $y_i = \beta_0 + \beta_1 x_1 + \varepsilon_i$

$$S_{xx} = 157.42 - \frac{43^2}{14}$$
$$= 25.348571$$
$$S_{xy} = 1697.80 - \frac{43(572)}{14}$$
$$= -59.057143$$
$$\hat{\beta}_1 = \frac{S_{xy}}{S_{xx}} = \frac{-59.057143}{25.348571} = -2.330$$
$$\hat{\beta}_0 = \bar{y} - \hat{\beta}_1 \bar{x} = \frac{572}{14} - (-2.3298017)\left(\frac{43}{14}\right) = 48.013$$

b) $\hat{y} = \hat{\beta}_0 + \hat{\beta}_1 x$

$$\hat{y} = 48.012962 - 2.3298017(4.3) = 37.99$$

c) $\hat{y} = 48.012962 - 2.3298017(3.7) = 39.39$

d) $e = y - \hat{y} = 46.1 - 39.39 = 6.71$