M.Sc. in ‚Transportation Systems‘

Applied Statistics in Transport

Exercises: Hypotheses Testing, Statistical Tests

1. In road construction for highways, the pavement is specified to be at least 0.5 centimetres thick by one of the many quality measures. The thickness is known to be N(μ, σ=0.2). The quality control system uses a significance level of 0.05. In 50 samples on one day, the mean thickness was 0.43 centimetres. Should the operator adjust the machine or is the thickness sufficient?

2. In a nuclear power plant, the cold start procedure consists of bringing the reactor to 35% of power, and then to 65% of power, before full operation. At each stage, engineers make measurements of several critical reactor attributes. If the binding energy does not have an exact mean rate of 11.5 MeV at 35% power, then the reactor could cascade into a critical configuration at subsequent power levels. Set up the hypothesis for a decision system at the 35% power level stage using $\alpha = 0.05$. It is known that the population of measurement errors is normal with standard deviation $\sigma = 1.5$. On this day's power-up, the sample mean of nine observations is 10.2 MeV. What should the operators of the reactor do?

3. Compute the two t-tests including the p-value and the confidence interval without the command t.test:

```
> t.test(1:10,7:20)

        Welch Two Sample t-test

data:  1:10 and 7:20
t = -5.4349, df = 21.982, p-value = 1.855e-05
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
 -11.052802  -4.947198
sample estimates:
mean of x mean of y 
      5.5      13.5 
> t.test(1:10)

        One Sample t-test

data:  1:10
t = 5.7446, df = 9, p-value = 0.0002782
alternative hypothesis: true mean is not equal to 0
95 percent confidence interval:
 3.334149 7.665851
sample estimates:
mean of x 
      5.5 
```