Typical exam questions

Applied Biostatistics I – Fall Semester 2018

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Part 1: 12 multiple choice questions

- Exactly 1 correct answer per question
- 1 point for each correct answer
- -1/2 point for wrong answer
- 0 points for no answer
- Many of them will be True / False statements
- Here are some examples:

Probability Theory

At a large university, the probability that a student takes calculus and statistics in the same semester is 0.0125. The probability that a student takes statistics is 0.125. Find the probability that a student is taking calculus, given that he or she is taking statistics.

a) 0.1

b) 0.1125

c) 0.0016

d) 0.1375

e) 0.4800

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a) 0.1 (= P(B|A) = P(A and B)/P(A) = 0.0125/0.125)

b) 0.1125

c) 0.0016

d) 0.1375

e) 0.4800

Using R

The R function ***pnorm*** calculates the cumulative distribution function, ***dnorm*** the probability density function, and ***qnorm*** the quantiles of the normal distribution.

True

False

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P values

The p-value is the probability that the null hypothesis is true.

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If P > alpha, we can usually accept the Null Hypothesis.

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Likelihood estimation

Maximizing the likelihood or the log-likelihood can sometimes yield different results.

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Hypothesis Testing

The significance threshold alpha controls the probability for a type I error (“false positive”).

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Summary statistics

The median is less robust than the mean when it comes to outliers.

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Multiple comparisons

We consider n = 100 000 genes and test each gene for differential gene expression. It is important to us to detect as many truly differentially expressed genes that will be tested subsequently using high-throughput methods. Which quantity is better to control:

Family wise error rate (FWER)

False discovery rate (FDR)

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Linear Regression

You perform a linear regression on a data set. You find a significant effect but R^2 is very low (0.1). Which interpretation is correct:

Even though there is an effect of the considered explanatory variable, it explains only about 10 % of the variation in the data.

It is likely that there is no effect at all and that our fining is a type 1 error.

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Part 2: 1 simple calculation example (6 points)

e.g.:

- Perform a statistical test by hand (6 steps!)
- Calculate a confidence interval
- Perform a correction for multiple testing by hand
- …