Rules: online test in lms, no proctoring, 20 questions, 60 minutes, only numerical answers are checked, two digits after decimal point are requested, use anything you want (calculators, python code, google, ...), don't cheat.

1. (bootstrap) I have a sample X_1, ..., X_{100}.

   I generate one naive bootstrap sample X_1^*, ..., X_{100}^*.

   What is the probability that the first observation will be present in the bootstrap sample 2 times or more?

2. (bootstrap) Nature generates random variables X_1, ..., X_{100} independently and uniformly on $[0; 10]$.

   I generate one naive bootstrap sample X_1^*, ..., X_{100}^*.

   Find the variance $\text{Var}(X_1^*)$.

3. (welch)

4. (welch)

5. (mw test)

6. (mw test)

7. (matching)

8. (matching)

9. (multiple comparison)

10. (multiple comparison)

11. (sample size)

12. (sample size)

13. (contingency table) I eated 10 M&Ms: 2 green, 1 red, 4 yellow, 1 green, 2 red.

    Only these three colors are possible. I assume that yellow and green colors are equally probable.

    Calculate the maximal log likelihood for my model.

14. (contingency table) Consider the following contingency table

	$B=1$	$B=2$
$A=1$	10	20
$A=2$	30	40

    Calculate LR statistic that checks the hypothesis that A and B are independent against dependency alternative.

15. (anova 1+2)

16. (anova 1+2)

17. (partial correlation) The variables X and Y are jointly normal with zero means, unit variances and $\text{Corr}(X, Y) = 0.8$.

    Find α such that $X^* = X - \alpha Y$ is not correlated with Y.

Short rules: 120 minutes, A4 cheat sheet and calculator are allowed, W_t always denotes a Wiener process.

18. (partial correlation) The variables X_1, X_2, ... are independent and identically distributed with mean 5 and variance 7.

    Find pCorr$(X_1, X_2; S)$ where $S = X_2 + X_3$.