PSY2014 Kvantitativ metode

- Written school examination.
- June 5, 2024 at 15:00-18:00 (3 hours).

About the exam

- The examination consists of three (3) questions. You shall answer all questions.
- The examination text is given in Norwegian and English and you may submit your response in Norwegian, Swedish, Danish or English.
- A list of relevant formulas and a table of the t-distribution are provided at the end of each attachment. Try to answer all questions.
- For tasks with PDF documents, you can zoon in with + and out with -. You can change the size of the PDF by clicking on the three dots in the margin and dragging.

Digital candidate instruction

- You will find the instructions for the school examination as an external resourcein the text. The candidate instruction show how UiO conducts for the school examination.

Examination support material

- Dictionaries handed in before the examination.
- Simple calculator without graphic display and text storage function.
- Simple calculator in Inspera.

Digital sketches

- You may use sketches to answer all questions.
- You are to use sketching paper handed to you.
- You can use more than one sketching sheet per question.
- Read the instruction for filling out sketching sheets.
- You will NOT be given extra time to fill out the "general information" on the sketching sheets (task kodes, candidate number etc.).

i

Exercise 1: Climate Anxiety Among Youth

In this exercise, we will examine how climate anxiety affects the future plans of young people. Climate anxiety refers to anxiety and concern related to climate change and its consequences.

We will look at results from analyses of data from 150 youths, and in addition to climate anxiety, the models will include variables such as social support, age, personality, and school grades.

The dataset we will analyze contains the following variables:

- Future Plans (FREMTIDSPLANER): Measured as the youth's score on a scale indicating how clear and positive their future plans are.
- Climate Anxiety (KLIMAANGST): Measured as a score on a scale indicating the degree of anxiety and concern about climate change.
- Extraversion (EKSTROVERSJON): Measured as a score on a scale indicating the degree of extraversion (outgoingness) of the youth.
- School Grades (SKOLEKARAKTERER): Average school grades, measured on a scale from 1 to 6.
- Social Support (SOSIAL_STOTTE): Measured as a score on a scale indicating how much support the youth feels they have from friends, family, and society in general.
- Age (ALDER): The youth's age in years.
- Age Squared (ALDER^2): The youth's age squared.
- SES (SES): Socioeconomic status, classified as low, middle, or high.

1(a) Excercise 1a:

Model 1: CLIMATE ANXIETY as the only independent variable.

1. In the document to the left, you will find output from the program R. How would you summarize the results from model 1 based on this output?
2. What is the expected score on FUTURE PLANS for a youth with a climate anxiety score of 10?
3. In the output, you will find a scatter plot with two observations marked A (red) and B (blue). How do you think these two observations affect the results? Do you think it is reasonable to remove one or both from the dataset?

Fill in your answer here

Format | B I U x₂ x² | Iₓ | | Ω | Σ |

Words: 0

Maximum marks: 0

Attaching sketches to this question?
Use the following code:

XXXXXXX

1(b) Excercise 1b:

Model 2: Inclusion of EXTRAVERSION and SCHOOL GRADES are added as Independent Variables

1. Explain why the coefficient for climate anxiety changes when extraversion and school grades are added to the model. Which of the variables extraversion and school grades do you think causes this change?

Fill in your answer here

Format B I U x_2 x^2 I_x Ω Σ

Words: 0

Maximum marks: 0

Attaching sketches to this question?
Use the following code:

X X X X X X X

1(c) Excercise 1c:

In Model 3, the independent variables SES and SOCIAL_SUPPORT are added.

1. Some of the values in the R output from this model are masked. Which of the following independent regression coefficients in Model 3 [climate anxiety, extraversion, school grades, sesLow, sesMedium, social_support] are statistically significantly associated with future plans at a 0.05 level? Justify your answer.
2. Regardless of significance, which of the variables "extraversion" and "social_support" would you argue is most strongly associated with future plans?
3. How would you summarize the relationship between socioeconomic status (SES) and future plans?

Fill in your answer here

Format B I U x_2 x^2 I_x Ω Σ

Words: 0

Maximum marks: 0

Attaching sketches to this question?
Use the following code:

X X X X X X X

1(d) Excercise 1d:

In this task, climate anxiety is the dependent variable, and we are interested in understanding how it is associated with age.

In Model 4a, age is the only independent variable, while Model 4b includes the independent variables age and age^2.

1. How do you understand the relationship between climate anxiety and age based on these results?
2. In the attached output, you will also find some diagnostic plots. Compare the scatter plots of Model 4a and 4b, and evaluate the diagnostic plots from Model 4b.

Fill in your answer here

Format B I U x_2 x^2 I_x Ω Σ

Words: 0

Maximum marks: 0

Attaching sketches to this question?
Use the following code:

XXXXXXX

2 Exercise 2: Music and Exercise Performance

Music has long been considered a motivational factor during exercise, and in this task, we will investigate how different types of music affect exercise performance. We will also assess whether the effect of music varies with the type of exercise, whether it is endurance training or strength training.

The dataset contains information on exercise performance among adults with different music types and training forms.

Variables:

- EXERCISE PERFORMANCE**:** Time spent on an exercise.
- MUSIC TYPE**:** No music, Electronic dance music, Hip-hop.
- ECERCISE FORM**:** Endurance, strength training.

1. Explain briefly the concepts of "within-group variance" and "between-group variance," and how the relationship between them can be used to evaluate the null hypothesis in an analysis of variance.
2. In the document to the left, you will find output from a one-way ANOVA for the factor MUSIC TYPE. Fill in the missing values in the attached table and conclude based on the results.
3. Next, a two-way ANOVA is conducted with the factors MUSIC TYPE and TRAINING FORM. Conclude based on the results from the analysis, and discuss what they say about the effect of music on training performance. Also, explain why the F-value for the factor MUSIC TYPE has changed from the one-way analysis.

Fill in your answer here

Format B I U Σ

Words: 0

Maximum marks: 0

Attaching sketches to this question?
Use the following code:

X X X X X X X

3 Exercise 3: Work Environment and Innovation

The work environment can significantly impact employees' ability to be innovative. In this task, we will investigate whether there is a relationship between different types of work environments and employees' innovation capabilities. The work environments being studied are "Clean desk," "Fixed desk in an open office," and "Individual offices." Innovation capability is categorized as high, medium, or low. Using chi-square analysis, we will assess whether the distribution of innovation capability differs among the three work environments.

Work Environments:

- Clean desk: A work environment where employees do not have fixed desks and are required to clear away all personal belongings at the end of the workday.
- Fixed desk in an open office: Employees have fixed desks in an open office layout without walls between workstations.
- Individual offices: Employees have their own offices with doors that can be closed.

1. What are the chi-square value, degrees of freedom, and p-value for this analysis? Are the results statistically significant at the 0.05 level?
2. What would you conclude about the relationship between the work environment and innovation capability based on the results?

Fill in your answer here

Format B I U x_2 x^2 I_x Ω Σ

Words: 0

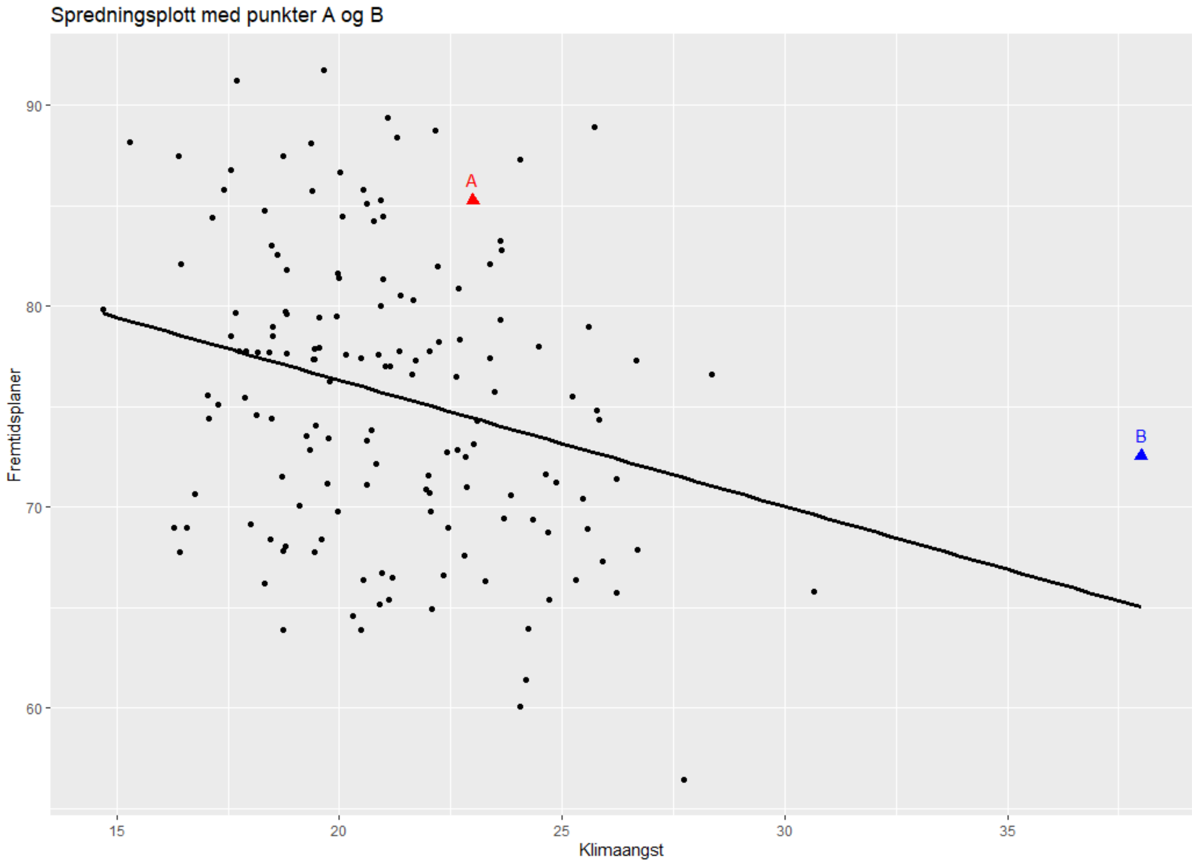
Maximum marks: 0

Attaching sketches to this question?
Use the following code:

X X X X X X X

Question 1.a
Attached

```
# ====================================================================
# Resultater fra modell 1

> modell_1 <- lm(fremtidsplaner ~ klimaangst, data = data)
> summary(modell1)

Call:
lm(formula = fremtidsplaner ~ klimaangst, data = data)

Residuals:
     Min       1Q   Median       3Q      Max 
-14.1358  -4.4990   0.1133   5.1687  16.8963 

Coefficients:
            Estimate Std. Error t value Pr(>|t|)    
(Intercept)  91.2386     4.1603  21.931  < 2e-16 ***
klimaangst   -0.7465     0.1958  -3.812 0.000202 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 6.92 on 148 degrees of freedom
Multiple R-squared:  0.0894,    Adjusted R-squared:  0.08324 
F-statistic: 14.53 on 1 and 148 DF,  p-value: 0.0002019
```



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Influensstatistikker for datapunktene A og B

Table: Diagnostics for Points A and B

Point	Leverage	Cook's Distance	Residual
A	0.009	0.011	10.843
B	0.191	0.171	7.544

Formelark for PSY2014

Gjennomsnitt: $\bar{X} = \frac{1}{n} \sum_{i=1}^{n} X_i$

Varians: $s_X^2 = \frac{\sum_{i=1}^{n}(X_i - \bar{X})^2}{n-1}$

Standardavvik: $s_X = \sqrt{s_X^2}$

Kovarians: $s_{XY} = \frac{\sum_{i=1}^{n}(X_i - \bar{X})(Y_i - \bar{Y})}{n-1}$

Pearson Korrelasjon: $r = \frac{s_{XY}}{s_X s_Y}$

Minste kvadraters estimater i bivariat regresjon. $\hat{b}_0 = \bar{Y} - \hat{b}_1 \cdot \bar{X}$ $\hat{b}_1 = \frac{\sum_{i=1}^{n}(X_i - \bar{X}) \cdot (Y_i - \bar{Y})}{\sum_{i=1}^{n}(X_i - \bar{X})^2} = \frac{s_{XY}}{s_X^2}$

Standardfeilen til estimatet av b_1 i en bivariat regresjon. $SE(\hat{b}_1) = \frac{s}{\sqrt{\sum(X_i - \bar{X})^2}}$ $s = \sqrt{\frac{\sum(Y - \hat{Y})^2}{n-p-1}}$

Standardisert regresjonskoeffisient $\beta_i = b_i \frac{s_X}{s_Y}$

Sums of squares: $\sum(Y_i - \bar{Y})^2 = \sum(\hat{Y}_i - \bar{Y})^2 + \sum(Y_i - \hat{Y}_i)^2$

r²: $r^2 = 1 - \frac{SSE}{TSS}$ $Justert\ r^2 = 1 - \frac{(n-1)(1-r^2)}{n-p-1}$

Z-skåre: $Z = \frac{X - \bar{X}}{s_X}$

F-ratio: $F = \frac{MSM}{MSE}$, er i en multippel regresjonsanalyse fordelt F(df_1=p, df_2=n-p-1) under H_0.

T-test: $t = \frac{\hat{b}_i}{SE(\hat{b}_i)}$, er i en multippel regresjonsanalyse fordelt t(df=n-p-1) under H_0.

Kji-kvadrat: $\chi^2 = \sum \frac{(O-E)^2}{E}$, fordelt $\chi^2(df = (Rader - 1)(Kol - 1))\ under\ H_0$ $E_{kol\ i, rad\ j} = \frac{R_j \times C_i}{n}$

Enveis Anova (mellom-gruppe design):

$SS_{between}$: $SS_b = \sum_{j=1}^{g}\sum_{i=1}^{n_j}(\bar{y}_j - \bar{y})^2 = \sum_{j=1}^{g} n_j(\bar{y}_j - \bar{y})^2$ $df_b = g - 1$

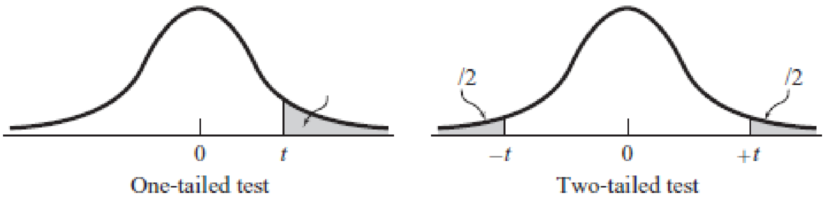
SS_{within}: $SS_w = \sum_{j=1}^{g}\sum_{i=1}^{n_j}(y_{ij} - \bar{y}_j)^2$ $df_w = n - g$

For "standardfeilen" (SE) til en differanse mellom to gjennomsnitt bruker vi:

$SE_{diff} = \sqrt{\frac{2\ MSS_w}{n}}$ (der *n* er antall personer innad i hver gruppe).

$t = \frac{x_1 - x_2}{SE_{diff}}$, med frihetsgrader (df) fra MSSw

T-tabell



	Level of Significance for One-Tailed Test								
	0.25	*0.20*	*0.15*	*0.10*	*0.05*	*0.025*	*0.01*	*0.005*	*0.0005*
	Level of Significance for Two-Tailed Test								
df	*0.50*	*0.40*	*0.30*	*0.20*	*0.10*	*0.05*	*0.02*	*0.01*	*0.001*
1	1.000	1.376	1.963	3.078	6.314	12.706	31.821	63.657	636.620
2	0.816	1.061	1.386	1.886	2.920	4.303	6.965	9.925	31.599
3	0.765	0.978	1.250	1.638	2.353	3.182	4.541	5.841	12.924
4	0.741	0.941	1.190	1.533	2.132	2.776	3.747	4.604	8.610
5	0.727	0.920	1.156	1.476	2.015	2.571	3.365	4.032	6.869
6	0.718	0.906	1.134	1.440	1.943	2.447	3.143	3.707	5.959
7	0.711	0.896	1.119	1.415	1.895	2.365	2.998	3.499	5.408
8	0.706	0.889	1.108	1.397	1.860	2.306	2.896	3.355	5.041
9	0.703	0.883	1.100	1.383	1.833	2.262	2.821	3.250	4.781
10	0.700	0.879	1.093	1.372	1.812	2.228	2.764	3.169	4.587
11	0.697	0.876	1.088	1.363	1.796	2.201	2.718	3.106	4.437
12	0.695	0.873	1.083	1.356	1.782	2.179	2.681	3.055	4.318
13	0.694	0.870	1.079	1.350	1.771	2.160	2.650	3.012	4.221
14	0.692	0.868	1.076	1.345	1.761	2.145	2.624	2.977	4.140
15	0.691	0.866	1.074	1.341	1.753	2.131	2.602	2.947	4.073
16	0.690	0.865	1.071	1.337	1.746	2.120	2.583	2.921	4.015
17	0.689	0.863	1.069	1.333	1.740	2.110	2.567	2.898	3.965
18	0.688	0.862	1.067	1.330	1.734	2.101	2.552	2.878	3.922
19	0.688	0.861	1.066	1.328	1.729	2.093	2.539	2.861	3.883
20	0.687	0.860	1.064	1.325	1.725	2.086	2.528	2.845	3.850
21	0.686	0.859	1.063	1.323	1.721	2.080	2.518	2.831	3.819
22	0.686	0.858	1.061	1.321	1.717	2.074	2.508	2.819	3.792
23	0.685	0.858	1.060	1.319	1.714	2.069	2.500	2.807	3.768
24	0.685	0.857	1.059	1.318	1.711	2.064	2.492	2.797	3.745
25	0.684	0.856	1.058	1.316	1.708	2.060	2.485	2.787	3.725
26	0.684	0.856	1.058	1.315	1.706	2.056	2.479	2.779	3.707
27	0.684	0.855	1.057	1.314	1.703	2.052	2.473	2.771	3.690
28	0.683	0.855	1.056	1.313	1.701	2.048	2.467	2.763	3.674
29	0.683	0.854	1.055	1.311	1.699	2.045	2.462	2.756	3.659
30	0.683	0.854	1.055	1.310	1.697	2.042	2.457	2.750	3.646
40	0.681	0.851	1.050	1.303	1.684	2.021	2.423	2.704	3.551
50	0.679	0.849	1.047	1.299	1.676	2.009	2.403	2.678	3.496
100	0.677	0.845	1.042	1.290	1.660	1.984	2.364	2.626	3.390
∞	0.674	0.842	1.036	1.282	1.645	1.960	2.326	2.576	3.291

Question 1.b

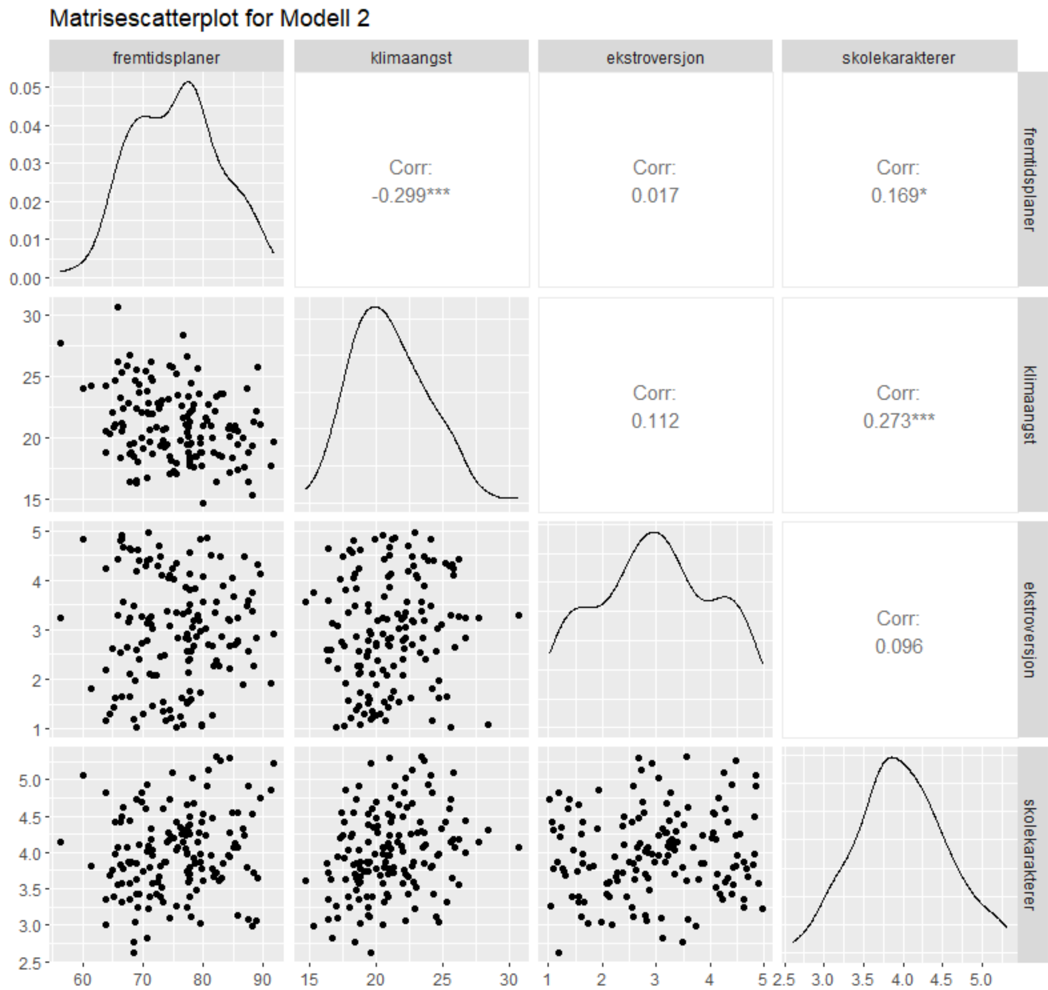
Attached

 # ==
 # Resultater fra modell 1

```
> summary(modell_1)

Call:
lm(formula = fremtidsplaner ~ klimaangst, data = data)

Residuals:
     Min       1Q   Median       3Q      Max 
-14.1358  -4.4990   0.1133   5.1687  16.8963 

Coefficients:
            Estimate Std. Error t value Pr(>|t|)    
(Intercept)  91.2386     4.1603  21.931  < 2e-16 ***
klimaangst   -0.7465     0.1958  -3.812 0.000202 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 6.92 on 148 degrees of freedom
Multiple R-squared:  0.0894,	Adjusted R-squared:  0.08324 
F-statistic: 14.53 on 1 and 148 DF,  p-value: 0.0002019
```

 # ==
 # Resultater fra modell 2

```
> summary(modell_2)

Call:
lm(formula = fremtidsplaner ~ klimaangst + ekstroversjon + 
skolekarakterer, 
    data = data)

Residuals:
     Min       1Q   Median       3Q      Max 
-16.7390  -4.2053  -0.0034   4.3803  18.6753 

Coefficients:
                Estimate Std. Error t value Pr(>|t|)    
(Intercept)      81.0668     5.0127  16.172  < 2e-16 ***
klimaangst       -0.9382     0.1978  -4.743 4.97e-06 ***
ekstroversjon     0.2165     0.5064   0.428 0.669605    
skolekarakterer   3.4033     1.0033   3.392 0.000892 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 6.699 on 146 degrees of freedom
Multiple R-squared:  0.1583,	Adjusted R-squared:  0.141 
F-statistic: 9.151 on 3 and 146 DF,  p-value: 1.376e-05
```




```
# ==================================================================
# Partielle korrelasjoner
> library(ppcor)
> pcor.test(fremtidsplaner, skolekarakterer, list(klimaangst,
ekstroversjon))
   estimate      p.value statistic   n gp  Method
1 0.2702901 0.0008924588  3.392188 150  2 pearson

> pcor.test(fremtidsplaner, ekstroversjon,
list(klimaangst,skolekarakterer ))
    estimate   p.value statistic   n gp  Method
1 0.03536256 0.6696052 0.4275548 150  2 pearson
```

Question 1.c
Attached

 # ==
 # Resultater fra modell 3

```
> summary(modell_3)

Call:
lm(formula = fremtidsplaner ~ klimaangst + ekstroversjon + 
skolekarakterer + 
    ses + sosial_stotte, data = data)

Residuals:
     Min       1Q   Median       3Q      Max 
-12.2717  -3.5860   0.0538   3.6815  13.1392 

Coefficients:
                Estimate Std. Error t value Pr(>|t|)    
(Intercept)      73.6049     8.9737   8.202 1.23e-13 ***
klimaangst       -0.7833     0.1571  -4.984 1.77e-06 ***
ekstroversjon     0.1868 [redacted] [redacted] [redacted]
skolekarakterer   3.3722     0.7983   4.224 4.25e-05 ***
sesLav          -10.8271     1.1392 [redacted]
sesMiddels       -5.3213 [redacted]
sosial_stotte     0.1428     0.1064   1.342 [redacted]
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 5.281 on 143 degrees of freedom
Multiple R-squared:  0.4877,    Adjusted R-squared:  0.4662 
F-statistic: 22.69 on 6 and 143 DF,  p-value: < 2.2e-16
```

 # ==
 # Konfidensintervaller fra modell 3

```
> confint(modell3)
                       2.5 %     97.5 %
(Intercept)      55.86668903 91.3430172
klimaangst       -1.09386622 -0.4726373
ekstroversjon    -0.60261852  0.9762644
skolekarakterer   1.79423492  4.9501718
sesLav          [redacted]
sesMiddels      [redacted] -3.2194050
sosial_stotte   [redacted]
```

 # ==
 # Standardiserte regresjonskoeffisienter fre modell 3

```
> lm.beta(modell3)

Call:
lm(formula = fremtidsplaner ~ klimaangst + ekstroversjon + 
skolekarakterer + 
    ses + sosial_stotte, data = data)

Standardized Coefficients::
```

```
    (Intercept)      klimaangst   ekstroversjon skolekarakterer
sesLav      sesMiddels   sosial_stotte
            NA     -0.31372658      0.02825797      0.26588336     -
0.69308307     -0.36460699      0.08151588
```

Samme tall lagt i en tabell for bedre leselighet

Variabel	**Standardisert Koeffisient**
Intercept	NA
Klimaangst	-0.314
Ekstroversjon	0.028
Skolekarakterer	0.266
SES Lav	-0.693
SES Middels	-0.365
Sosial støtte	0.082

Formelark for PSY2014

Gjennomsnitt: $\bar{X} = \frac{1}{n} \sum_{i=1}^{n} X_i$

Varians: $s_X^2 = \frac{\sum_{i=1}^{n}(X_i - \bar{X})^2}{n-1}$

Standardavvik: $s_X = \sqrt{s_X^2}$

Kovarians: $s_{XY} = \frac{\sum_{i=1}^{n}(X_i - \bar{X})(Y_i - \bar{Y})}{n-1}$

Pearson Korrelasjon: $r = \frac{s_{XY}}{s_X s_Y}$

Minste kvadraters estimater i bivariat regresjon. $\hat{b}_0 = \bar{Y} - \hat{b}_1 \cdot \bar{X}$ $\hat{b}_1 = \frac{\sum_{i=1}^{n}(X_i - \bar{X}) \cdot (Y_i - \bar{Y})}{\sum_{i=1}^{n}(X_i - \bar{X})^2} = \frac{s_{XY}}{s_X^2}$

Standardfeilen til estimatet av b_1 i en bivariat regresjon. $SE(\hat{b}_1) = \frac{s}{\sqrt{\sum(X_i - \bar{X})^2}}$ $s = \sqrt{\frac{\sum(Y - \hat{Y})^2}{n - p - 1}}$

Standardisert regresjonskoeffisient $\beta_i = b_i \frac{s_X}{s_Y}$

Sums of squares: $\sum(Y_i - \bar{Y})^2 = \sum(\hat{Y}_i - \bar{Y})^2 + \sum(Y_i - \hat{Y}_i)^2$

r²: $r^2 = 1 - \frac{SSE}{TSS}$ $Justert\ r^2 = 1 - \frac{(n-1)(1-r^2)}{n-p-1}$

Z-skåre: $Z = \frac{X - \bar{X}}{s_X}$

F-ratio: $F = \frac{MSM}{MSE}$, er i en multippel regresjonsanalyse fordelt F(df_1=p, df_2=n-p-1) under H_0.

T-test: $t = \frac{\hat{b}_i}{SE(\hat{b}_i)}$, er i en multippel regresjonsanalyse fordelt t(df=n-p-1) under H_0.

Kji-kvadrat: $\chi^2 = \sum \frac{(O-E)^2}{E}$, fordelt $\chi^2(df = (Rader - 1)(Kol - 1))\ under\ H_0$ $E_{kol\ i, rad\ j} = \frac{R_j \times C_i}{n}$

Enveis Anova (mellom-gruppe design):

$SS_{between}$: $SS_b = \sum_{j=1}^{g} \sum_{i=1}^{n_j} (\bar{y}_j - \bar{y})^2 = \sum_{j=1}^{g} n_j (\bar{y}_j - \bar{y})^2$ $df_b = g - 1$

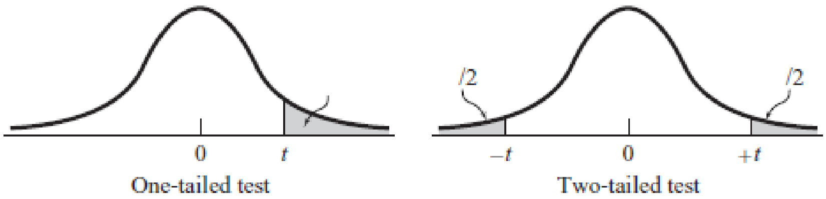
SS_{within}: $SS_w = \sum_{j=1}^{g} \sum_{i=1}^{n_j} (y_{ij} - \bar{y}_j)^2$ $df_w = n - g$

For "standardfeilen" (SE) til en differanse mellom to gjennomsnitt bruker vi:

$SE_{diff} = \sqrt{\frac{2\, MSS_w}{n}}$ (der *n* er antall personer innad i hver gruppe).

$t = \frac{x_1 - x_2}{SE_{diff}}$, med frihetsgrader (df) fra MSSw

T-tabell

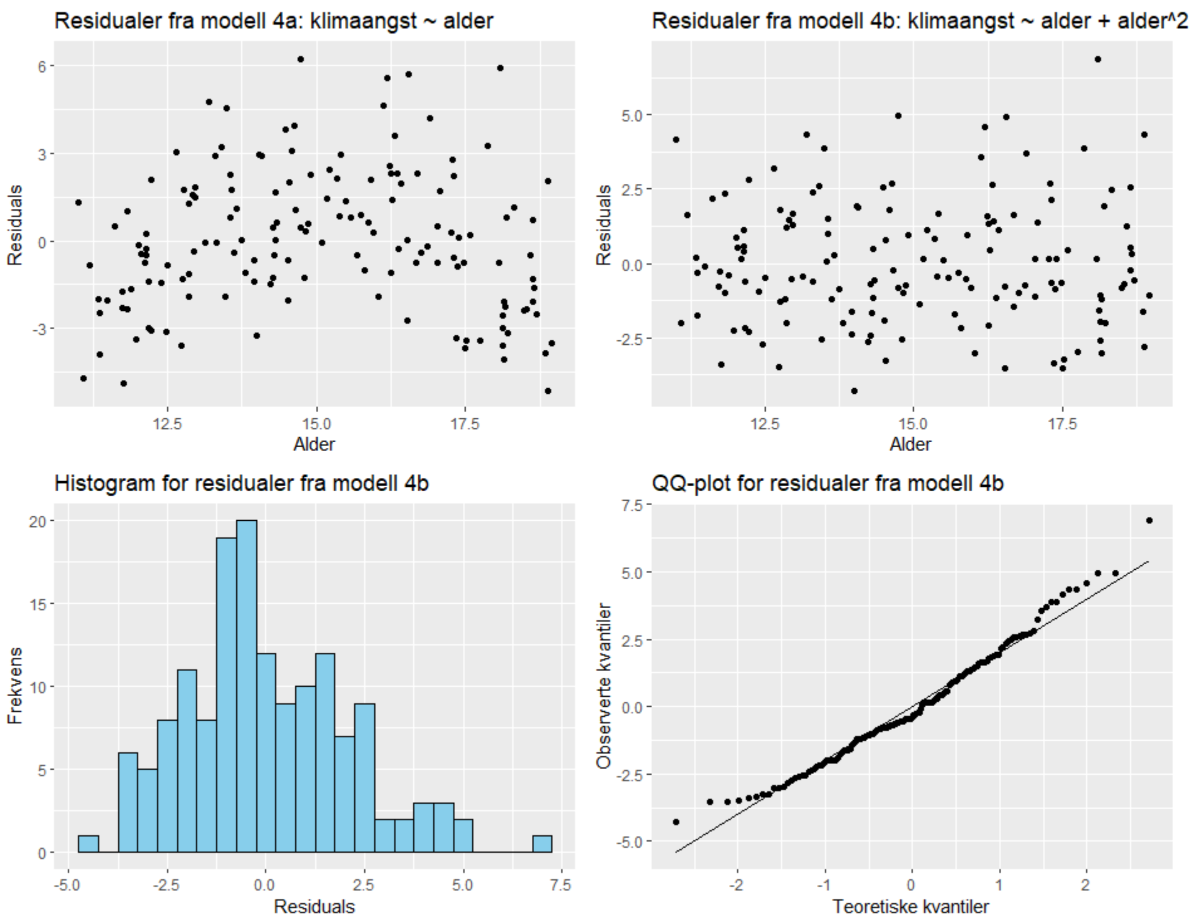


	Level of Significance for One-Tailed Test								
	0.25	*0.20*	*0.15*	*0.10*	*0.05*	*0.025*	*0.01*	*0.005*	*0.0005*
	Level of Significance for Two-Tailed Test								
df	*0.50*	*0.40*	*0.30*	*0.20*	*0.10*	*0.05*	*0.02*	*0.01*	*0.001*
1	1.000	1.376	1.963	3.078	6.314	12.706	31.821	63.657	636.620
2	0.816	1.061	1.386	1.886	2.920	4.303	6.965	9.925	31.599
3	0.765	0.978	1.250	1.638	2.353	3.182	4.541	5.841	12.924
4	0.741	0.941	1.190	1.533	2.132	2.776	3.747	4.604	8.610
5	0.727	0.920	1.156	1.476	2.015	2.571	3.365	4.032	6.869
6	0.718	0.906	1.134	1.440	1.943	2.447	3.143	3.707	5.959
7	0.711	0.896	1.119	1.415	1.895	2.365	2.998	3.499	5.408
8	0.706	0.889	1.108	1.397	1.860	2.306	2.896	3.355	5.041
9	0.703	0.883	1.100	1.383	1.833	2.262	2.821	3.250	4.781
10	0.700	0.879	1.093	1.372	1.812	2.228	2.764	3.169	4.587
11	0.697	0.876	1.088	1.363	1.796	2.201	2.718	3.106	4.437
12	0.695	0.873	1.083	1.356	1.782	2.179	2.681	3.055	4.318
13	0.694	0.870	1.079	1.350	1.771	2.160	2.650	3.012	4.221
14	0.692	0.868	1.076	1.345	1.761	2.145	2.624	2.977	4.140
15	0.691	0.866	1.074	1.341	1.753	2.131	2.602	2.947	4.073
16	0.690	0.865	1.071	1.337	1.746	2.120	2.583	2.921	4.015
17	0.689	0.863	1.069	1.333	1.740	2.110	2.567	2.898	3.965
18	0.688	0.862	1.067	1.330	1.734	2.101	2.552	2.878	3.922
19	0.688	0.861	1.066	1.328	1.729	2.093	2.539	2.861	3.883
20	0.687	0.860	1.064	1.325	1.725	2.086	2.528	2.845	3.850
21	0.686	0.859	1.063	1.323	1.721	2.080	2.518	2.831	3.819
22	0.686	0.858	1.061	1.321	1.717	2.074	2.508	2.819	3.792
23	0.685	0.858	1.060	1.319	1.714	2.069	2.500	2.807	3.768
24	0.685	0.857	1.059	1.318	1.711	2.064	2.492	2.797	3.745
25	0.684	0.856	1.058	1.316	1.708	2.060	2.485	2.787	3.725
26	0.684	0.856	1.058	1.315	1.706	2.056	2.479	2.779	3.707
27	0.684	0.855	1.057	1.314	1.703	2.052	2.473	2.771	3.690
28	0.683	0.855	1.056	1.313	1.701	2.048	2.467	2.763	3.674
29	0.683	0.854	1.055	1.311	1.699	2.045	2.462	2.756	3.659
30	0.683	0.854	1.055	1.310	1.697	2.042	2.457	2.750	3.646
40	0.681	0.851	1.050	1.303	1.684	2.021	2.423	2.704	3.551
50	0.679	0.849	1.047	1.299	1.676	2.009	2.403	2.678	3.496
100	0.677	0.845	1.042	1.290	1.660	1.984	2.364	2.626	3.390
∞	0.674	0.842	1.036	1.282	1.645	1.960	2.326	2.576	3.291

Question 1.d
Attached

```
# ================================================================
# Resultater fra modell 4a

> summary(modell_4a)

Call:
lm(formula = klimaangst ~ alder, data = data)

Coefficients:
            Estimate Std. Error t value Pr(>|t|)
(Intercept) 56.33276    1.29984   43.34   <2e-16 ***
alder        0.97203    0.08548   11.37   <2e-16 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 2.397 on 148 degrees of freedom
Multiple R-squared:  0.4663, Adjusted R-squared:  0.4627
F-statistic: 129.3 on 1 and 148 DF,  p-value: < 2.2e-16


# ================================================================
# Resultater fra modell 4b

> summary(modell_4b)

Call:
lm(formula = klimaangst ~ alder + alder2, data = data)

Residuals:
    Min      1Q  Median      3Q     Max
-4.2817 -1.3435 -0.3652  1.3566  6.8920

Coefficients:
            Estimate Std. Error t value Pr(>|t|)
(Intercept)  0.47695    8.30783   0.057    0.954
alder        8.55301    1.11945   7.640 2.57e-12 ***
alder2      -0.25130    0.03703  -6.787 2.62e-10 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 2.099 on 147 degrees of freedom
Multiple R-squared:  0.5937, Adjusted R-squared:  0.5881
F-statistic: 107.4 on 2 and 147 DF,  p-value: < 2.2e-16


# ================================================================
# AIC-verdier for modell 4a og 4b

> print(aic_values)
         df      AIC
modell4a  3 691.9248
modell4b  4 653.0342
```

```
# ===================================================================
# Sammenlikning av modell 4a og 4b (anova funksjonen)

> print(anova_values)
Analysis of Variance Table

Model 1: klimaangst ~ alder
Model 2: klimaangst ~ alder + alder2
  Res.Df    RSS Df Sum of Sq      F    Pr(>F)
1    148 850.30
2    147 647.41  1    202.89 46.067 2.619e-10 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
```



Formelark for PSY2014

Gjennomsnitt:
$$\bar{X} = \frac{1}{n} \sum_{i=1}^{n} X_i$$

Varians:
$$s_X^2 = \frac{\sum_{i=1}^{n}(X_i - \bar{X})^2}{n-1}$$

Standardavvik:
$$s_X = \sqrt{s_X^2}$$

Kovarians:
$$s_{XY} = \frac{\sum_{i=1}^{n}(X_i - \bar{X})(Y_i - \bar{Y})}{n-1}$$

Pearson Korrelasjon:
$$r = \frac{s_{XY}}{s_X s_Y}$$

Minste kvadraters estimater i bivariat regresjon.
$$\hat{b}_0 = \bar{Y} - \hat{b}_1 \cdot \bar{X} \qquad \hat{b}_1 = \frac{\sum_{i=1}^{n}(X_i - \bar{X}) \cdot (Y_i - \bar{Y})}{\sum_{i=1}^{n}(X_i - \bar{X})^2} = \frac{s_{XY}}{s_X^2}$$

Standardfeilen til estimatet av b_1 i en bivariat regresjon.
$$SE(\hat{b}_1) = \frac{s}{\sqrt{\sum(X_i - \bar{X})^2}} \qquad s = \sqrt{\frac{\sum(Y - \hat{Y})^2}{n-p-1}}$$

Standardisert regresjonskoeffisient
$$\beta_i = b_i \frac{s_X}{s_Y}$$

Sums of squares:
$$\sum(Y_i - \bar{Y})^2 = \sum(\hat{Y}_i - \bar{Y})^2 + \sum(Y_i - \hat{Y}_i)^2$$

r^2:
$$r^2 = 1 - \frac{SSE}{TSS} \qquad Justert\ r^2 = 1 - \frac{(n-1)(1-r^2)}{n-p-1}$$

Z-skåre:
$$Z = \frac{X - \bar{X}}{s_X}$$

F-ratio:

$F = \frac{MSM}{MSE}$, er i en multippel regresjonsanalyse fordelt F(df_1=p, df_2=n-p-1) under H_0.

T-test:

$t = \frac{\hat{b}_i}{SE(\hat{b}_i)}$, er i en multippel regresjonsanalyse fordelt t(df=n-p-1) under H_0.

Kji-kvadrat: $\chi^2 = \sum \frac{(O-E)^2}{E}$, fordelt $\chi^2(df = (Rader - 1)(Kol - 1))\ under\ H_0$ $\qquad E_{kol\ i, rad\ j} = \frac{R_j \times C_i}{n}$

Enveis Anova (mellom-gruppe design):

$SS_{between}$: $SS_b = \sum_{j=1}^{g} \sum_{i=1}^{n_j} (\bar{y}_j - \bar{y})^2 = \sum_{j=1}^{g} n_j (\bar{y}_j - \bar{y})^2 \qquad df_b = g - 1$

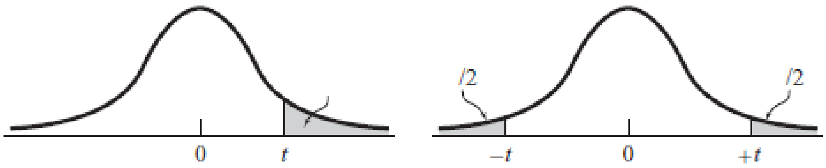
SS_{within} : $SS_w = \sum_{j=1}^{g} \sum_{i=1}^{n_j} (y_{ij} - \bar{y}_j)^2 \qquad df_w = n - g$

For "standardfeilen" (SE) til en differanse mellom to gjennomsnitt bruker vi:

$SE_{diff} = \sqrt{\frac{2\,MSS_w}{n}}$ (der *n* er antall personer innad i hver gruppe).

$t = \frac{x_1 - x_2}{SE_{diff}}$, med frihetsgrader (df) fra MSSw

T-tabell

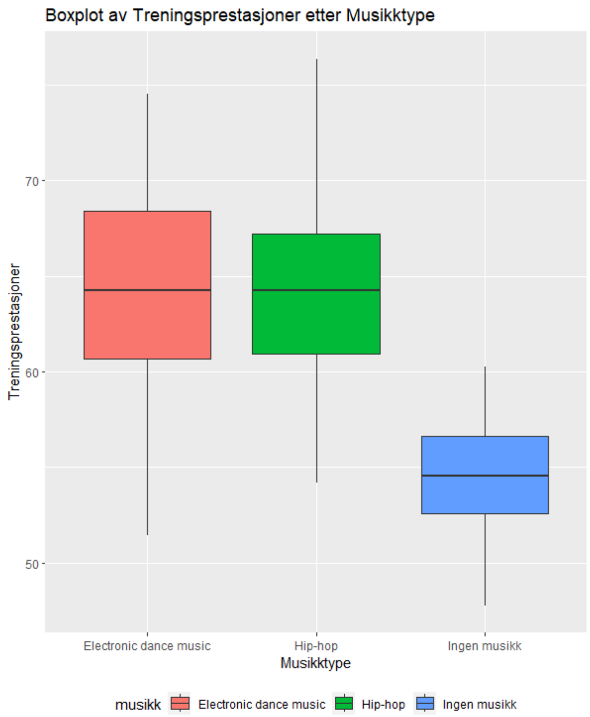


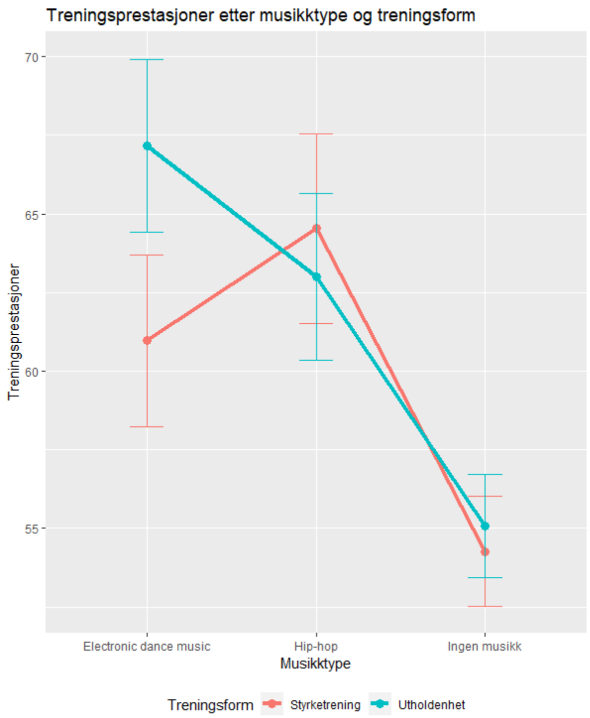
One-tailed test   Two-tailed test

	Level of Significance for One-Tailed Test								
	0.25	0.20	0.15	0.10	0.05	0.025	0.01	0.005	0.0005
	Level of Significance for Two-Tailed Test								
df	0.50	0.40	0.30	0.20	0.10	0.05	0.02	0.01	0.001
1	1.000	1.376	1.963	3.078	6.314	12.706	31.821	63.657	636.620
2	0.816	1.061	1.386	1.886	2.920	4.303	6.965	9.925	31.599
3	0.765	0.978	1.250	1.638	2.353	3.182	4.541	5.841	12.924
4	0.741	0.941	1.190	1.533	2.132	2.776	3.747	4.604	8.610
5	0.727	0.920	1.156	1.476	2.015	2.571	3.365	4.032	6.869
6	0.718	0.906	1.134	1.440	1.943	2.447	3.143	3.707	5.959
7	0.711	0.896	1.119	1.415	1.895	2.365	2.998	3.499	5.408
8	0.706	0.889	1.108	1.397	1.860	2.306	2.896	3.355	5.041
9	0.703	0.883	1.100	1.383	1.833	2.262	2.821	3.250	4.781
10	0.700	0.879	1.093	1.372	1.812	2.228	2.764	3.169	4.587
11	0.697	0.876	1.088	1.363	1.796	2.201	2.718	3.106	4.437
12	0.695	0.873	1.083	1.356	1.782	2.179	2.681	3.055	4.318
13	0.694	0.870	1.079	1.350	1.771	2.160	2.650	3.012	4.221
14	0.692	0.868	1.076	1.345	1.761	2.145	2.624	2.977	4.140
15	0.691	0.866	1.074	1.341	1.753	2.131	2.602	2.947	4.073
16	0.690	0.865	1.071	1.337	1.746	2.120	2.583	2.921	4.015
17	0.689	0.863	1.069	1.333	1.740	2.110	2.567	2.898	3.965
18	0.688	0.862	1.067	1.330	1.734	2.101	2.552	2.878	3.922
19	0.688	0.861	1.066	1.328	1.729	2.093	2.539	2.861	3.883
20	0.687	0.860	1.064	1.325	1.725	2.086	2.528	2.845	3.850
21	0.686	0.859	1.063	1.323	1.721	2.080	2.518	2.831	3.819
22	0.686	0.858	1.061	1.321	1.717	2.074	2.508	2.819	3.792
23	0.685	0.858	1.060	1.319	1.714	2.069	2.500	2.807	3.768
24	0.685	0.857	1.059	1.318	1.711	2.064	2.492	2.797	3.745
25	0.684	0.856	1.058	1.316	1.708	2.060	2.485	2.787	3.725
26	0.684	0.856	1.058	1.315	1.706	2.056	2.479	2.779	3.707
27	0.684	0.855	1.057	1.314	1.703	2.052	2.473	2.771	3.690
28	0.683	0.855	1.056	1.313	1.701	2.048	2.467	2.763	3.674
29	0.683	0.854	1.055	1.311	1.699	2.045	2.462	2.756	3.659
30	0.683	0.854	1.055	1.310	1.697	2.042	2.457	2.750	3.646
40	0.681	0.851	1.050	1.303	1.684	2.021	2.423	2.704	3.551
50	0.679	0.849	1.047	1.299	1.676	2.009	2.403	2.678	3.496
100	0.677	0.845	1.042	1.290	1.660	1.984	2.364	2.626	3.390
∞	0.674	0.842	1.036	1.282	1.645	1.960	2.326	2.576	3.291

Question 2.a

Attached






```
# ====================================================================
# Enveis ANOVA

> anova_musikk <- aov(prestasjoner ~ musikk, data = data)
> summary(anova_musikk)
            Df  Sum Sq Mean Sq F value    Pr(>F)
musikk      [redacted]   1708  [redacted]   37.26 2.04e-12 ***
Residuals   87    1994    22.9
---
Signif. codes:
0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


# ====================================================================
# eta^2

> effectsize::eta_squared(anova_musikk)

Parameter | Eta2 |       95% CI
-------------------------------
musikk    | 0.46 | [0.33, 1.00]
```

(utskriften fortsetter under)

 # ==
 # Posthoc t-tester

```
> pairwise_no_corr <- pairwise.t.test(data$prestasjoner,
data$musikk, p.adjust.method = "none")
> print(pairwise_no_corr)

     Pairwise comparisons using t tests with pooled SD

data:  data$prestasjoner and data$musikk

             Electronic dance music Hip-hop
Hip-hop      0.81                   -
Ingen musikk 3.3e-11                1.0e-10

P value adjustment method: none
```

 # ==
 # Bonferroni korrigerte posthoc t-tester

```
> print(pairwise_bonf)

     Pairwise comparisons using t tests with pooled SD

data:  data$prestasjoner and data$musikk

             Electronic dance music Hip-hop
Hip-hop      1                      -
Ingen musikk 9.8e-11                3.0e-10

P value adjustment method: bonferroni
```

 # ==
 # Toveis ANOVA

```
> # Toveis ANOVA (musikktype og treningsform)
> anova_musikk_trening <- aov(prestasjoner ~ musikk * trening, data
= data)
> summary(anova_musikk_trening)
               Df Sum Sq Mean Sq F value   Pr(>F)
musikk          2 1708.4   854.2  42.640 1.65e-13 ***
trening         1   75.3    75.3   3.758  0.05590 .
musikk:trening  2  236.3   118.1   5.898  0.00401 **
Residuals      84 1682.7    20.0
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' '
```

Formelark for PSY2014

Gjennomsnitt: $\bar{X} = \frac{1}{n} \sum_{i=1}^{n} X_i$

Varians: $s_X^2 = \frac{\sum_{i=1}^{n}(X_i - \bar{X})^2}{n-1}$

Standardavvik: $s_X = \sqrt{s_X^2}$

Kovarians: $s_{XY} = \frac{\sum_{i=1}^{n}(X_i - \bar{X})(Y_i - \bar{Y})}{n-1}$

Pearson Korrelasjon: $r = \frac{s_{XY}}{s_X s_Y}$

Minste kvadraters estimater i bivariat regresjon. $\hat{b}_0 = \bar{Y} - \hat{b}_1 \cdot \bar{X}$ $\quad \hat{b}_1 = \frac{\sum_{i=1}^{n}(X_i - \bar{X}) \cdot (Y_i - \bar{Y})}{\sum_{i=1}^{n}(X_i - \bar{X})^2} = \frac{s_{XY}}{s_X^2}$

Standardfeilen til estimatet av b_1 i en bivariat regresjon. $SE(\hat{b}_1) = \frac{s}{\sqrt{\sum(X_i - \bar{X})^2}}$ $\quad s = \sqrt{\frac{\sum(Y - \hat{Y})^2}{n-p-1}}$

Standardisert regresjonskoeffisient $\beta_i = b_i \frac{s_X}{s_Y}$

Sums of squares: $\sum(Y_i - \bar{Y})^2 = \sum(\hat{Y}_i - \bar{Y})^2 + \sum(Y_i - \hat{Y}_i)^2$

r^2: $r^2 = 1 - \frac{SSE}{TSS}$ $\quad Justert\ r^2 = 1 - \frac{(n-1)(1-r^2)}{n-p-1}$

Z-skåre: $Z = \frac{X - \bar{X}}{s_X}$

F-ratio: $F = \frac{MSM}{MSE}$, er i en multippel regresjonsanalyse fordelt F(df_1=p, df_2=n-p-1) under H_0.

T-test: $t = \frac{\hat{b}_i}{SE(\hat{b}_i)}$, er i en multippel regresjonsanalyse fordelt t(df=n-p-1) under H_0.

Kji-kvadrat: $\chi^2 = \sum \frac{(O-E)^2}{E}$, fordelt $\chi^2(df = (Rader - 1)(Kol - 1))\ under\ H_0$ $\quad E_{kol\ i,radj} = \frac{R_j \times C_i}{n}$

Enveis Anova (mellom-gruppe design):

$SS_{between}$: $SS_b = \sum_{j=1}^{g} \sum_{i=1}^{n_j} (\bar{y}_j - \bar{y})^2 = \sum_{j=1}^{g} n_j (\bar{y}_j - \bar{y})^2$ $\quad df_b = g - 1$

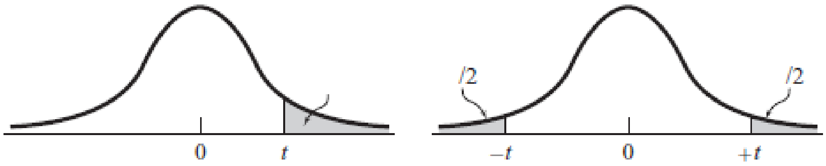
SS_{within} : $SS_w = \sum_{j=1}^{g} \sum_{i=1}^{n_j} (y_{ij} - \bar{y}_j)^2$ $\quad df_w = n - g$

For "standardfeilen" (SE) til en differanse mellom to gjennomsnitt bruker vi:

$SE_{diff} = \sqrt{\frac{2\,MSS_w}{n}}$ (der *n* er antall personer innad i hver gruppe).

$t = \frac{x_1 - x_2}{SE_{diff}}$, med frihetsgrader (df) fra MSSw

T-tabell



One-tailed test Two-tailed test

	Level of Significance for One-Tailed Test								
	0.25	0.20	0.15	0.10	0.05	0.025	0.01	0.005	0.0005
	Level of Significance for Two-Tailed Test								
df	0.50	0.40	0.30	0.20	0.10	0.05	0.02	0.01	0.001
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2	0.816	1.061	1.386	1.886	2.920	4.303	6.965	9.925	31.599
3	0.765	0.978	1.250	1.638	2.353	3.182	4.541	5.841	12.924
4	0.741	0.941	1.190	1.533	2.132	2.776	3.747	4.604	8.610
5	0.727	0.920	1.156	1.476	2.015	2.571	3.365	4.032	6.869
6	0.718	0.906	1.134	1.440	1.943	2.447	3.143	3.707	5.959
7	0.711	0.896	1.119	1.415	1.895	2.365	2.998	3.499	5.408
8	0.706	0.889	1.108	1.397	1.860	2.306	2.896	3.355	5.041
9	0.703	0.883	1.100	1.383	1.833	2.262	2.821	3.250	4.781
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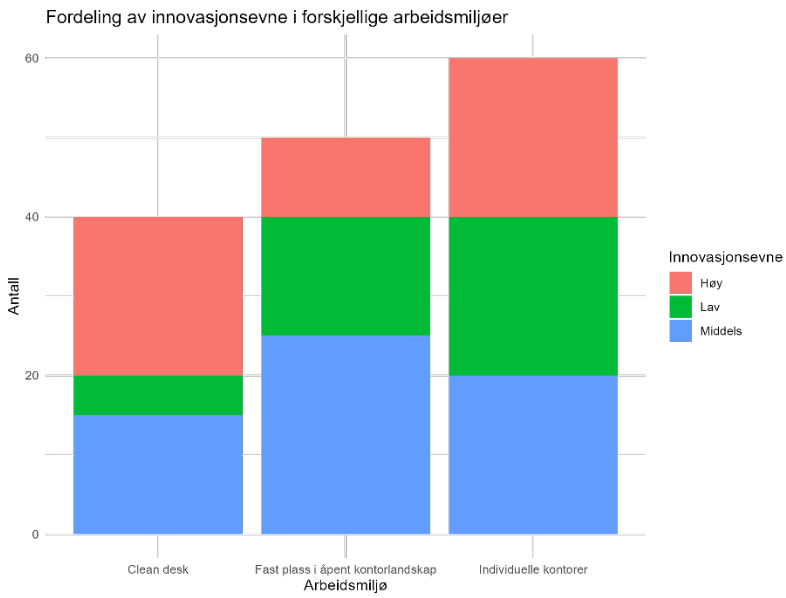
11	0.697	0.876	1.088	1.363	1.796	2.201	2.718	3.106	4.437
12	0.695	0.873	1.083	1.356	1.782	2.179	2.681	3.055	4.318
13	0.694	0.870	1.079	1.350	1.771	2.160	2.650	3.012	4.221
14	0.692	0.868	1.076	1.345	1.761	2.145	2.624	2.977	4.140
15	0.691	0.866	1.074	1.341	1.753	2.131	2.602	2.947	4.073
16	0.690	0.865	1.071	1.337	1.746	2.120	2.583	2.921	4.015
17	0.689	0.863	1.069	1.333	1.740	2.110	2.567	2.898	3.965
18	0.688	0.862	1.067	1.330	1.734	2.101	2.552	2.878	3.922
19	0.688	0.861	1.066	1.328	1.729	2.093	2.539	2.861	3.883
20	0.687	0.860	1.064	1.325	1.725	2.086	2.528	2.845	3.850
21	0.686	0.859	1.063	1.323	1.721	2.080	2.518	2.831	3.819
22	0.686	0.858	1.061	1.321	1.717	2.074	2.508	2.819	3.792
23	0.685	0.858	1.060	1.319	1.714	2.069	2.500	2.807	3.768
24	0.685	0.857	1.059	1.318	1.711	2.064	2.492	2.797	3.745
25	0.684	0.856	1.058	1.316	1.708	2.060	2.485	2.787	3.725
26	0.684	0.856	1.058	1.315	1.706	2.056	2.479	2.779	3.707
27	0.684	0.855	1.057	1.314	1.703	2.052	2.473	2.771	3.690
28	0.683	0.855	1.056	1.313	1.701	2.048	2.467	2.763	3.674
29	0.683	0.854	1.055	1.311	1.699	2.045	2.462	2.756	3.659
30	0.683	0.854	1.055	1.310	1.697	2.042	2.457	2.750	3.646
40	0.681	0.851	1.050	1.303	1.684	2.021	2.423	2.704	3.551
50	0.679	0.849	1.047	1.299	1.676	2.009	2.403	2.678	3.496
100	0.677	0.845	1.042	1.290	1.660	1.984	2.364	2.626	3.390
∞	0.674	0.842	1.036	1.282	1.645	1.960	2.326	2.576	3.291

Question 3.a
Attached



Kji-kvadrattabell

df	0.995	0.990	0.975	0.950	0.900	0.750	0.500	0.250	0.100	0.050	0.025	0.010	0.005
1	0.00	0.00	0.00	0.00	0.02	0.10	0.45	1.32	2.71	3.84	5.02	6.63	7.88
2	0.01	0.02	0.05	0.10	0.21	0.58	1.39	2.77	4.61	5.99	7.38	9.21	10.60
3	0.07	0.11	0.22	0.35	0.58	1.21	2.37	4.11	6.25	7.82	9.35	11.35	12.84
4	0.21	0.30	0.48	0.71	1.06	1.92	3.36	5.39	7.78	9.49	11.14	13.28	14.86
5	0.41	0.55	0.83	1.15	1.61	2.67	4.35	6.63	9.24	11.07	12.83	15.09	16.75
6	0.68	0.87	1.24	1.64	2.20	3.45	5.35	7.84	10.64	12.59	14.45	16.81	18.55

```
# ============================================================
# Kji-kvadrat-analyse

> chi_sq <- chisq.test(table_data)
> print(chi_sq)

	Pearson's Chi-squared test

data:  table_data
X-squared = 12.198, df = [redacted], p-value = [redacted]


# ==============================================================
# Frekvenstabell

> table(data$arbeidsmiljo, data$innovasjonsevne)

                                   Høy Lav Middels
  Clean desk                        20   5      15
  Fast plass i åpent kontorlandskap 10  15      25
  Individuelle kontorer             20  20      20
```

```
# ===============================================================
# Residualer

> round(chi_sq$residuals,2)

                                    Høy   Lav Middels
  Clean desk                       1.83 -1.74   -0.25
  Fast plass i åpent kontorlandskap -1.63  0.46    1.12
  Individuelle kontorer            0.00  1.00   -0.82
```

```
# ========================================================================
# Standardiserte residualer

> round(chi_sq$stdres, 2)

                                   Høy   Lav Middels
  Clean desk                      2.61 -2.37   -0.38
  Fast plass i åpent kontorlandskap -2.45  0.65    1.77
  Individuelle kontorer           0.00  1.51   -1.36
```

Formelark for PSY2014

Gjennomsnitt: $\bar{X} = \frac{1}{n} \sum_{i=1}^{n} X_i$

Varians: $$s_X^2 = \frac{\sum_{i=1}^{n}(X_i - \bar{X})^2}{n-1}$$

Standardavvik: $$s_X = \sqrt{s_X^2}$$

Kovarians: $$s_{XY} = \frac{\sum_{i=1}^{n}(X_i - \bar{X})(Y_i - \bar{Y})}{n-1}$$

Pearson Korrelasjon: $$r = \frac{s_{XY}}{s_X s_Y}$$

Minste kvadraters estimater i bivariat regresjon.
$$\hat{b}_0 = \bar{Y} - \hat{b}_1 \cdot \bar{X} \qquad \hat{b}_1 = \frac{\sum_{i=1}^{n}(X_i - \bar{X}) \cdot (Y_i - \bar{Y})}{\sum_{i=1}^{n}(X_i - \bar{X})^2} = \frac{s_{XY}}{s_X^2}$$

Standardfeilen til estimatet av b_1 i en bivariat regresjon.
$$SE(\hat{b}_1) = \frac{s}{\sqrt{\sum(X_i - \bar{X})^2}} \qquad s = \sqrt{\frac{\sum(Y - \hat{Y})^2}{n-p-1}}$$

Standardisert regresjonskoeffisient $$\beta_i = b_i \frac{s_X}{s_Y}$$

Sums of squares: $$\sum(Y_i - \bar{Y})^2 = \sum(\hat{Y}_i - \bar{Y})^2 + \sum(Y_i - \hat{Y}_i)^2$$

r^2: $$r^2 = 1 - \frac{SSE}{TSS} \qquad Justert\ r^2 = 1 - \frac{(n-1)(1-r^2)}{n-p-1}$$

Z-skåre: $$Z = \frac{X - \bar{X}}{s_X}$$

F-ratio: $F = \frac{MSM}{MSE}$, er i en multippel regresjonsanalyse fordelt F(df_1=p, df_2=n-p-1) under H_0.

T-test: $t = \frac{\hat{b}_i}{SE(\hat{b}_i)}$, er i en multippel regresjonsanalyse fordelt t(df=n-p-1) under H_0.

Kji-kvadrat: $\chi^2 = \sum \frac{(O-E)^2}{E}$, fordelt $\chi^2(df = (Rader - 1)(Kol - 1))\ under\ H_0$ $\qquad E_{kol\ i,radj} = \frac{R_j \times C_i}{n}$

Enveis Anova (mellom-gruppe design):

$SS_{between}$: $SS_b = \sum_{j=1}^{g} \sum_{i=1}^{n_j} (\bar{y}_j - \bar{y})^2 = \sum_{j=1}^{g} n_j (\bar{y}_j - \bar{y})^2 \qquad df_b = g - 1$

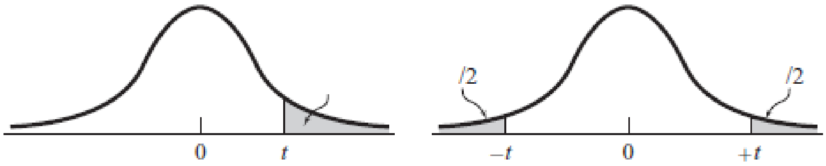
SS_{within} : $SS_w = \sum_{j=1}^{g} \sum_{i=1}^{n_j} (y_{ij} - \bar{y}_j)^2 \qquad df_w = n - g$

For "standardfeilen" (SE) til en differanse mellom to gjennomsnitt bruker vi:

$SE_{diff} = \sqrt{\frac{2\,MSS_w}{n}}$ (der *n* er antall personer innad i hver gruppe).

$t = \frac{x_1 - x_2}{SE_{diff}}$, med frihetsgrader (df) fra MSSw

T-tabell



One-tailed test Two-tailed test

	Level of Significance for One-Tailed Test								
	0.25	0.20	0.15	0.10	0.05	0.025	0.01	0.005	0.0005
	Level of Significance for Two-Tailed Test								
df	0.50	0.40	0.30	0.20	0.10	0.05	0.02	0.01	0.001
1	1.000	1.376	1.963	3.078	6.314	12.706	31.821	63.657	636.620
2	0.816	1.061	1.386	1.886	2.920	4.303	6.965	9.925	31.599
3	0.765	0.978	1.250	1.638	2.353	3.182	4.541	5.841	12.924
4	0.741	0.941	1.190	1.533	2.132	2.776	3.747	4.604	8.610
5	0.727	0.920	1.156	1.476	2.015	2.571	3.365	4.032	6.869
6	0.718	0.906	1.134	1.440	1.943	2.447	3.143	3.707	5.959
7	0.711	0.896	1.119	1.415	1.895	2.365	2.998	3.499	5.408
8	0.706	0.889	1.108	1.397	1.860	2.306	2.896	3.355	5.041
9	0.703	0.883	1.100	1.383	1.833	2.262	2.821	3.250	4.781
10	0.700	0.879	1.093	1.372	1.812	2.228	2.764	3.169	4.587
11	0.697	0.876	1.088	1.363	1.796	2.201	2.718	3.106	4.437
12	0.695	0.873	1.083	1.356	1.782	2.179	2.681	3.055	4.318
13	0.694	0.870	1.079	1.350	1.771	2.160	2.650	3.012	4.221
14	0.692	0.868	1.076	1.345	1.761	2.145	2.624	2.977	4.140
15	0.691	0.866	1.074	1.341	1.753	2.131	2.602	2.947	4.073
16	0.690	0.865	1.071	1.337	1.746	2.120	2.583	2.921	4.015
17	0.689	0.863	1.069	1.333	1.740	2.110	2.567	2.898	3.965
18	0.688	0.862	1.067	1.330	1.734	2.101	2.552	2.878	3.922
19	0.688	0.861	1.066	1.328	1.729	2.093	2.539	2.861	3.883
20	0.687	0.860	1.064	1.325	1.725	2.086	2.528	2.845	3.850
21	0.686	0.859	1.063	1.323	1.721	2.080	2.518	2.831	3.819
22	0.686	0.858	1.061	1.321	1.717	2.074	2.508	2.819	3.792
23	0.685	0.858	1.060	1.319	1.714	2.069	2.500	2.807	3.768
24	0.685	0.857	1.059	1.318	1.711	2.064	2.492	2.797	3.745
25	0.684	0.856	1.058	1.316	1.708	2.060	2.485	2.787	3.725
26	0.684	0.856	1.058	1.315	1.706	2.056	2.479	2.779	3.707
27	0.684	0.855	1.057	1.314	1.703	2.052	2.473	2.771	3.690
28	0.683	0.855	1.056	1.313	1.701	2.048	2.467	2.763	3.674
29	0.683	0.854	1.055	1.311	1.699	2.045	2.462	2.756	3.659
30	0.683	0.854	1.055	1.310	1.697	2.042	2.457	2.750	3.646
40	0.681	0.851	1.050	1.303	1.684	2.021	2.423	2.704	3.551
50	0.679	0.849	1.047	1.299	1.676	2.009	2.403	2.678	3.496
100	0.677	0.845	1.042	1.290	1.660	1.984	2.364	2.626	3.390
∞	0.674	0.842	1.036	1.282	1.645	1.960	2.326	2.576	3.291