**Testing Models for Age Demographic**

> library(gmodels)

> mage <- lm(skills ~ -1 + age, data = df)

> summary(mage)

Call:

lm(formula = skills ~ -1 + age, data = df)

Residuals:

Min 1Q Median 3Q Max

-11.933 -1.849 0.380 1.672 7.718

Coefficients:

Estimate Std. Error t value Pr(>|t|)

age18-19 17.6486 0.3285 53.730 <2e-16 \*\*\*

age20-21 16.8528 0.3285 51.307 <2e-16 \*\*\*

age22-25 16.8816 0.6163 27.394 <2e-16 \*\*\*

age31 and above 21.0200 2.1788 9.647 <2e-16 \*\*\*

---

Signif. codes: 0 ‘\*\*\*’ 0.001 ‘\*\*’ 0.01 ‘\*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 3.081 on 199 degrees of freedom

Multiple R-squared: 0.9697, Adjusted R-squared: 0.9691

F-statistic: 1591 on 4 and 199 DF, p-value: < 2.2e-16

>

> ### Create a matrices of contrasts with 1 contrast per line

> ### Here we create linear combinations of the means where

> ### we subtract one mean from the other using 1 and -1 and

> ### 0 drops the mean from the test so we are only looking

> ### at pairwise comparisons

>

> #compare 18-19 with 20-21

> age.1819v2021 <- matrix(c(1, -1, 0, 0),

+ nrow = 1,

+ ncol = 4,

+ byrow = TRUE)

>

> #compare 18-19 with 22-25

> age.1819v2225 <- matrix(c(1, 0, -1, 0),

+ nrow = 1,

+ ncol = 4,

+ byrow = TRUE)

>

> #compare 18-19 with average of to middle age categories

> age.1819v2025 <- matrix(c(1, -1/2, -1/2, 0),

+ nrow = 1,

+ ncol = 4,

+ byrow = TRUE)

>

> #compare 18-19 with oldest category

> age.1819v31 <- matrix(c(1, 0, 0, -1),

+ nrow = 1,

+ ncol = 4,

+ byrow = TRUE)

>

> #Compare average of 20-25 with oldest group

> age.31v2025 <- matrix(c(0, -1/2, -1/2, 1),

+ nrow = 1,

+ ncol = 4,

+ byrow = TRUE)

>

> ### Now we use tests of general linear hypotheses (glh) to

> ### test for differences in the groups

> glh.test(mage,

+ cm = age.1819v2021)

Test of General Linear Hypothesis

Call:

glh.test(reg = mage, cm = age.1819v2021)

F = 2.9349, df1 = 1, df2 = 199, p-value = 0.08824

>

> glh.test(mage,

+ cm = age.1819v2225)

Test of General Linear Hypothesis

Call:

glh.test(reg = mage, cm = age.1819v2225)

F = 1.2064, df1 = 1, df2 = 199, p-value = 0.2734

>

> glh.test(mage,

+ cm = age.1819v2025)

Test of General Linear Hypothesis

Call:

glh.test(reg = mage, cm = age.1819v2025)

F = 2.657, df1 = 1, df2 = 199, p-value = 0.1047

>

> glh.test(mage,

+ cm = age.1819v31)

Test of General Linear Hypothesis

Call:

glh.test(reg = mage, cm = age.1819v31)

F = 2.3411, df1 = 1, df2 = 199, p-value = 0.1276

>

> glh.test(mage,

+ cm = age.31v2025)

Test of General Linear Hypothesis

Call:

glh.test(reg = mage, cm = age.31v2025)

F = 3.5418, df1 = 1, df2 = 199, p-value = 0.0613

> mageemot <- lm(emot ~ -1 + age, data = df)

> summary(mageemot)

Call:

lm(formula = emot ~ -1 + age, data = df)

Residuals:

Min 1Q Median 3Q Max

-6.6775 -1.6975 -0.0875 1.4375 5.9225

Coefficients:

Estimate Std. Error t value Pr(>|t|)

age18-19 9.8648 0.2691 36.663 < 2e-16 \*\*\*

age20-21 9.8275 0.2691 36.525 < 2e-16 \*\*\*

age22-25 10.6300 0.5048 21.057 < 2e-16 \*\*\*

age31 and above 11.9550 1.7848 6.698 2.11e-10 \*\*\*

---

Signif. codes: 0 ‘\*\*\*’ 0.001 ‘\*\*’ 0.01 ‘\*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 2.524 on 199 degrees of freedom

Multiple R-squared: 0.9409, Adjusted R-squared: 0.9397

F-statistic: 791.6 on 4 and 199 DF, p-value: < 2.2e-16

>

>

> #Running contrast code/general linear hypothesis testing for age and AE emot

> library(gmodels)

> mageemot <- lm(emot ~ -1 + age, data = df)

> summary(mageemot)

Call:

lm(formula = emot ~ -1 + age, data = df)

Residuals:

Min 1Q Median 3Q Max

-6.6775 -1.6975 -0.0875 1.4375 5.9225

Coefficients:

Estimate Std. Error t value Pr(>|t|)

age18-19 9.8648 0.2691 36.663 < 2e-16 \*\*\*

age20-21 9.8275 0.2691 36.525 < 2e-16 \*\*\*

age22-25 10.6300 0.5048 21.057 < 2e-16 \*\*\*

age31 and above 11.9550 1.7848 6.698 2.11e-10 \*\*\*

---

Signif. codes: 0 ‘\*\*\*’ 0.001 ‘\*\*’ 0.01 ‘\*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 2.524 on 199 degrees of freedom

Multiple R-squared: 0.9409, Adjusted R-squared: 0.9397

F-statistic: 791.6 on 4 and 199 DF, p-value: < 2.2e-16

>

> ### Create a matrices of contrasts with 1 contrast per line

> ### Here we create linear combinations of the means where

> ### we subtract one mean from the other using 1 and -1 and

> ### 0 drops the mean from the test so we are only looking

> ### at pairwise comparisons

>

> #compare 18-19 with 20-21

> age.1819v2021 <- matrix(c(1, -1, 0, 0),

+ nrow = 1,

+ ncol = 4,

+ byrow = TRUE)

>

> #compare 18-19 with 22-25

> age.1819v2225 <- matrix(c(1, 0, -1, 0),

+ nrow = 1,

+ ncol = 4,

+ byrow = TRUE)

>

> #compare 18-19 with oldest category

> age.1819v31 <- matrix(c(1, 0, 0, -1),

+ nrow = 1,

+ ncol = 4,

+ byrow = TRUE)

>

> #compare average of 18-21 with 22-25

> age.1821v2225 <- matrix(c(-1/2, -1/2, 1, 0),

+ nrow = 1,

+ ncol = 4,

+ byrow = TRUE)

>

> #Compare average of 18-21 with oldest group

> age.31v1821 <- matrix(c(-1/2, -1/2, 0, 1),

+ nrow = 1,

+ ncol = 4,

+ byrow = TRUE)

>

> ### Now we use tests of general linear hypotheses (glh) to

> ### test for differences in the groups

> glh.test(mageemot,

+ cm = age.1819v2021)

Test of General Linear Hypothesis

Call:

glh.test(reg = mageemot, cm = age.1819v2021)

F = 0.0096, df1 = 1, df2 = 199, p-value = 0.9221

>

> glh.test(mageemot,

+ cm = age.1819v2225)

Test of General Linear Hypothesis

Call:

glh.test(reg = mageemot, cm = age.1819v2225)

F = 1.7895, df1 = 1, df2 = 199, p-value = 0.1825

>

> glh.test(mageemot,

+ cm = age.1819v31)

Test of General Linear Hypothesis

Call:

glh.test(reg = mageemot, cm = age.1819v31)

F = 1.3411, df1 = 1, df2 = 199, p-value = 0.2482

>

> glh.test(mageemot,

+ cm = age.1821v2225)

Test of General Linear Hypothesis

Call:

glh.test(reg = mageemot, cm = age.1821v2225)

F = 2.1113, df1 = 1, df2 = 199, p-value = 0.1478

>

> glh.test(mageemot,

+ cm = age.31v1821)

Test of General Linear Hypothesis

Call:

glh.test(reg = mageemot, cm = age.31v1821)

F = 1.3805, df1 = 1, df2 = 199, p-value = 0.2414

> magepart <- lm(part ~ -1 + age, data = df)

> summary(magepart)

Call:

lm(formula = part ~ -1 + age, data = df)

Residuals:

Min 1Q Median 3Q Max

-5.7044 -1.8915 -0.2804 1.9431 6.8256

Coefficients:

Estimate Std. Error t value Pr(>|t|)

age18-19 10.2544 0.3032 33.817 < 2e-16 \*\*\*

age20-21 10.5663 0.3050 34.647 < 2e-16 \*\*\*

age22-25 11.2372 0.5689 19.752 < 2e-16 \*\*\*

age31 and above 13.4600 2.0114 6.692 2.21e-10 \*\*\*

---

Signif. codes: 0 ‘\*\*\*’ 0.001 ‘\*\*’ 0.01 ‘\*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 2.845 on 198 degrees of freedom

(1 observation deleted due to missingness)

Multiple R-squared: 0.9335, Adjusted R-squared: 0.9321

F-statistic: 694.7 on 4 and 198 DF, p-value: < 2.2e-16

> #Running contrast code/general linear hypothesis testing for age and AE part

> library(gmodels)

> magepart <- lm(part ~ -1 + age, data = df)

> summary(magepart)

Call:

lm(formula = part ~ -1 + age, data = df)

Residuals:

Min 1Q Median 3Q Max

-5.7044 -1.8915 -0.2804 1.9431 6.8256

Coefficients:

Estimate Std. Error t value Pr(>|t|)

age18-19 10.2544 0.3032 33.817 < 2e-16 \*\*\*

age20-21 10.5663 0.3050 34.647 < 2e-16 \*\*\*

age22-25 11.2372 0.5689 19.752 < 2e-16 \*\*\*

age31 and above 13.4600 2.0114 6.692 2.21e-10 \*\*\*

---

Signif. codes: 0 ‘\*\*\*’ 0.001 ‘\*\*’ 0.01 ‘\*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 2.845 on 198 degrees of freedom

(1 observation deleted due to missingness)

Multiple R-squared: 0.9335, Adjusted R-squared: 0.9321

F-statistic: 694.7 on 4 and 198 DF, p-value: < 2.2e-16

>

> ### Create a matrices of contrasts with 1 contrast per line

> ### Here we create linear combinations of the means where

> ### we subtract one mean from the other using 1 and -1 and

> ### 0 drops the mean from the test so we are only looking

> ### at pairwise comparisons

>

> #compare 18-19 with 20-21

> age.1819v2021 <- matrix(c(1, -1, 0, 0),

+ nrow = 1,

+ ncol = 4,

+ byrow = TRUE)

>

> #compare 18-19 with 22-25

> age.1819v2225 <- matrix(c(1, 0, -1, 0),

+ nrow = 1,

+ ncol = 4,

+ byrow = TRUE)

>

> #compare 18-19 with oldest category

> age.1819v31 <- matrix(c(1, 0, 0, -1),

+ nrow = 1,

+ ncol = 4,

+ byrow = TRUE)

>

> #compare average of 18-25 with oldest group

> age.1825v31 <- matrix(c(-1/3, -1/3, -1/3, 1),

+ nrow = 1,

+ ncol = 4,

+ byrow = TRUE)

>

>

> ### Now we use tests of general linear hypotheses (glh) to

> ### test for differences in the groups

> glh.test(magepart,

+ cm = age.1819v2021)

Test of General Linear Hypothesis

Call:

glh.test(reg = magepart, cm = age.1819v2021)

F = 0.5259, df1 = 1, df2 = 198, p-value = 0.4692

>

> glh.test(magepart,

+ cm = age.1819v2225)

Test of General Linear Hypothesis

Call:

glh.test(reg = magepart, cm = age.1819v2225)

F = 2.3239, df1 = 1, df2 = 198, p-value = 0.129

>

> glh.test(magepart,

+ cm = age.1819v31)

Test of General Linear Hypothesis

Call:

glh.test(reg = magepart, cm = age.1819v31)

F = 2.4834, df1 = 1, df2 = 198, p-value = 0.1166

>

> glh.test(magepart,

+ cm = age.1825v31)

Test of General Linear Hypothesis

Call:

glh.test(reg = magepart, cm = age.1825v31)

F = 1.8759, df1 = 1, df2 = 198, p-value = 0.1724

> mageperf <- lm(perf ~ -1 + age, data = df)

> summary(mageperf)

Call:

lm(formula = perf ~ -1 + age, data = df)

Residuals:

Min 1Q Median 3Q Max

-6.1717 -0.9672 0.0983 0.8683 2.3978

Coefficients:

Estimate Std. Error t value Pr(>|t|)

age18-19 8.0522 0.1582 50.896 < 2e-16 \*\*\*

age20-21 8.2617 0.1582 52.221 < 2e-16 \*\*\*

age22-25 8.2240 0.2968 27.707 < 2e-16 \*\*\*

age31 and above 8.0200 1.0494 7.642 8.84e-13 \*\*\*

---

Signif. codes: 0 ‘\*\*\*’ 0.001 ‘\*\*’ 0.01 ‘\*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 1.484 on 199 degrees of freedom

Multiple R-squared: 0.9686, Adjusted R-squared: 0.968

F-statistic: 1536 on 4 and 199 DF, p-value: < 2.2e-16

> #Running contrast code/general linear hypothesis testing for age and AE perf

> library(gmodels)

> mageperf <- lm(perf ~ -1 + age, data = df)

> summary(mageperf)

Call:

lm(formula = perf ~ -1 + age, data = df)

Residuals:

Min 1Q Median 3Q Max

-6.1717 -0.9672 0.0983 0.8683 2.3978

Coefficients:

Estimate Std. Error t value Pr(>|t|)

age18-19 8.0522 0.1582 50.896 < 2e-16 \*\*\*

age20-21 8.2617 0.1582 52.221 < 2e-16 \*\*\*

age22-25 8.2240 0.2968 27.707 < 2e-16 \*\*\*

age31 and above 8.0200 1.0494 7.642 8.84e-13 \*\*\*

---

Signif. codes: 0 ‘\*\*\*’ 0.001 ‘\*\*’ 0.01 ‘\*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 1.484 on 199 degrees of freedom

Multiple R-squared: 0.9686, Adjusted R-squared: 0.968

F-statistic: 1536 on 4 and 199 DF, p-value: < 2.2e-16

>

> ### Create a matrices of contrasts with 1 contrast per line

> ### Here we create linear combinations of the means where

> ### we subtract one mean from the other using 1 and -1 and

> ### 0 drops the mean from the test so we are only looking

> ### at pairwise comparisons

>

> #compare 18-19 with 20-21

> age.1819v2021 <- matrix(c(1, -1, 0, 0),

+ nrow = 1,

+ ncol = 4,

+ byrow = TRUE)

>

> #compare 18-19 with 22-25

> age.1819v2225 <- matrix(c(1, 0, -1, 0),

+ nrow = 1,

+ ncol = 4,

+ byrow = TRUE)

>

> #compare 18-19 with oldest category

> age.1819v31 <- matrix(c(1, 0, 0, -1),

+ nrow = 1,

+ ncol = 4,

+ byrow = TRUE)

>

> #compare 20-21 with 22-25

> age.2021v2225 <- matrix(c(0, 1, -1, 0),

+ nrow = 1,

+ ncol = 4,

+ byrow = TRUE)

>

> #compare 20-21 with oldest group

> age.2021v31 <- matrix(c(0, 1, 0, -1),

+ nrow = 1,

+ ncol = 4,

+ byrow = TRUE)

>

> #compare 22-25 with oldest group

> age.2225v31 <- matrix(c(0, 1, -1, 0),

+ nrow = 1,

+ ncol = 4,

+ byrow = TRUE)

>

> ### Now we use tests of general linear hypotheses (glh) to

> ### test for differences in the groups

> glh.test(mageperf,

+ cm = age.1819v2021)

Test of General Linear Hypothesis

Call:

glh.test(reg = mageperf, cm = age.1819v2021)

F = 0.8771, df1 = 1, df2 = 199, p-value = 0.3501

>

> glh.test(mageperf,

+ cm = age.1819v2225)

Test of General Linear Hypothesis

Call:

glh.test(reg = mageperf, cm = age.1819v2225)

F = 0.261, df1 = 1, df2 = 199, p-value = 0.61

>

> glh.test(mageperf,

+ cm = age.1819v31)

Test of General Linear Hypothesis

Call:

glh.test(reg = mageperf, cm = age.1819v31)

F = 9e-04, df1 = 1, df2 = 199, p-value = 0.9759

>

> glh.test(mageperf,

+ cm = age.2021v2225)

Test of General Linear Hypothesis

Call:

glh.test(reg = mageperf, cm = age.2021v2225)

F = 0.0126, df1 = 1, df2 = 199, p-value = 0.9109

>

> glh.test(mageperf,

+ cm = age.2021v31)

Test of General Linear Hypothesis

Call:

glh.test(reg = mageperf, cm = age.2021v31)

F = 0.0519, df1 = 1, df2 = 199, p-value = 0.8201

>

> glh.test(mageperf,

+ cm = age.2225v31)

Test of General Linear Hypothesis

Call:

glh.test(reg = mageperf, cm = age.2225v31)

F = 0.0126, df1 = 1, df2 = 199, p-value = 0.9109