Q1.   As a variable at the student level that is essential for explaining English score, we use the measure for IQ taken from a study. The IQ score has been centered, so that its mean is 0. Its standard deviation in this data set is 2.84. This is calculated as a descriptive statistic, without taking the grouping into account. Given that also the standard deviation of English score is 8.56. The results are presented in the table below:

Fixed effect	Coefficient	S.E.
$\gamma_{00}=$ intercept	37.86	0.28
$\gamma_{10}=$ coefficient of IQ	2.279	0.085
Random part	Variance component	S.E.
Level-two variance: $\tau_0^2 = \mathrm{var}(U_{oj})$	8.67	1.37
Level-one variance: $\sigma^2 = \mathrm{var}(R_{ij})$	42.28	0.96
Deviance	24,065	

(a)   write down the general regression equation.
(b)   estimate an equation for a school with a typical low average achievement (bottom 2.5%).
(c)   estimate an equation for a school with a typical high average achievement (top 2.5%).
(d)   compute the standardised coefficient and interpret its meaning. 0.7561
(e)   estimate the residual intraclass correlation and interpret its meaning.
(f)   test whether the coefficient of IQ were 0.

You are required to:
(a)   write down the general regression equation. $Y_{ij} = 37.86 + 2.279IQ + U_{oj} + R_{ij}$

(b)   estimate an equation for a school with a typical low average achievement (bottom 2.5%). $Y = 37.86 + 2.279IQ - 2\sqrt{8.67} = 31.97 + 2.279IQ$

(c)   estimate an equation for a school with a typical low average achievement (top 2.5%). $Y = 37.86 + 2.279IQ + 2\sqrt{8.67} = 43.7490 + 2.279IQ$

(d)   compute the standardised coefficient and interpret its meaning. 0.7561
75.61% of total variation in Y can be explained by X.

(e)   estimate the residual intraclass correlation and interpret its meaning. 0.1702
(f)   test whether the coefficient of IQ were 0.

Q2.   Provide five situations where random coefficient models should be used.

Q3   As a variable at the student level that is essential for explaining Economics score, we use the measure for revision hours per month taken from a study. The revision hours has been centered, so that its mean is 0. The standard deviation for revision hours and economics score are 1.67 and 8.89 respectively. The results are presented below.

Fixed effect	Coefficient	S.E.
$\gamma_{00} = \text{intercept}$	43.45	0.28
$\gamma_{10} = \text{coefficient of revision hour}$	2.457	0.126
$\gamma_{01} = \text{coefficient of } \overline{\text{RH}} \, (\text{group mean})$	1.386	0.235
Random part	Variance component	S.E.
Level-two variance: $\tau_0^2 = \text{var}(U_{oj})$	9.27	1.36
Level-one variance: $\sigma^2 = \text{var}(R_{ij})$	44.23	0.86
Deviance	25,076	

*RH = revision hours

Revision hours here is the variable with overall centering but no group centering.

You are required to:
(a)   write down the general regression equation.
(b)   estimate an equation for a school with a typical low average achievement (bottom 2.5%).
(c)   estimate an equation for a school with a typical high average achievement (top 2.5%).
(d)   compute the standardised coefficient and interpret its meaning.
(e)   estimate the residual intraclass correlation and interpret its meaning.
(f)   test whether the coefficient of average revision hours were 0.

Answe:

1a)