Python Program Output (Terminal)

```
Question 1

                            OLS Regression Results
==============================================================================
Dep. Variable:                agefbrth   R-squared:                       0.059
Model:                            OLS   Adj. R-squared:                  0.057
Method:                 Least Squares   F-statistic:                     29.05
Date:                Sun, 10 Dec 2023   Prob (F-statistic):           1.86e-23
Time:                        21:34:43   Log-Likelihood:                -4806.2
No. Observations:                1870   AIC:                             9622.
Df Residuals:                    1865   BIC:                             9650.
Df Model:                           4
Covariance Type:            nonrobust
==============================================================================
                 coef    std err          t      P>|t|      [0.025      0.975]
------------------------------------------------------------------------------
Intercept     18.9301      0.294     64.291      0.000      18.353      19.508
ceb           -0.1600      0.034     -4.673      0.000      -0.227      -0.093
monthfm        0.0416      0.020      2.057      0.040       0.002       0.081
idlnchld      -0.0105      0.034     -0.310      0.756      -0.077       0.056
educ           0.1306      0.019      6.843      0.000       0.093       0.168
==============================================================================
Omnibus:                      507.611   Durbin-Watson:                   1.921
Prob(Omnibus):                  0.000   Jarque-Bera (JB):             1670.058
Skew:                           1.338   Prob(JB):                         0.00
Kurtosis:                       6.778   Cond. No.                         43.8
==============================================================================

Notes:
[1] Standard Errors assume that the covariance matrix of the errors is correctly specified.

Estimated slope for 'educ':  0.131
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Question 2

Formula for the testing regression model: educ ~ ceb + monthfm + idlnchld + electric

Robust t-statistic for 'electric': 18.322
P-value for 'electric': 0.000
```

Question 3 (Pt.1)

OLS Regression Results

Dep. Variable:	agefbrth	R-squared:	1.000
Model:	OLS	Adj. R-squared:	1.000
Method:	Least Squares	F-statistic:	4.034e+30
Date:	Sun, 10 Dec 2023	Prob (F-statistic):	0.00
Time:	21:34:43	Log-Likelihood:	55587.
No. Observations:	1870	AIC:	-1.112e+05
Df Residuals:	1864	BIC:	-1.111e+05
Df Model:	5		
Covariance Type:	HC3		

	coef	std err	z	P>|z|	[0.025	0.975]
Intercept	18.9301	3.45e-15	5.49e+15	0.000	18.930	18.930
educ	0.1306	1.92e-16	6.82e+14	0.000	0.131	0.131
educ_resid	1.0000	2.28e-16	4.38e+15	0.000	1.000	1.000
ceb	-0.1600	5.49e-16	-2.92e+14	0.000	-0.160	-0.160
monthfm	0.0416	1.89e-16	2.2e+14	0.000	0.042	0.042
idlnchld	-0.0105	7.96e-16	-1.32e+13	0.000	-0.011	-0.011

Omnibus:	215.458	Durbin-Watson:	1.783
Prob(Omnibus):	0.000	Jarque-Bera (JB):	591.100
Skew:	-0.621	Prob(JB):	4.41e-129
Kurtosis:	5.459	Cond. No.	43.8

Notes:
[1] Standard Errors are heteroscedasticity robust (HC3)

Test for Constraints

	coef	std err	z	P>|z|	[0.025	0.975]
c0	1.0000	2.28e-16	4.38e+15	0.000	1.000	1.000

```
Question 3 (Pt. 2)

                          IV-2SLS Estimation Summary
==============================================================================
Dep. Variable:               agefbrth   R-squared:                      0.0048
Estimator:                   IV-2SLS   Adj. R-squared:                 0.0027
No. Observations:               1870   F-statistic:                    26.899
Date:                Sun, Dec 10 2023   P-value (F-stat)                0.0000
Time:                        22:34:22   Distribution:                F(4,1865)
Cov. Estimator:                robust

                             Parameter Estimates
==============================================================================
            Parameter  Std. Err.     T-stat    P-value    Lower CI    Upper CI
------------------------------------------------------------------------------
Intercept      17.097     0.4954     34.513     0.0000      16.126      18.069
ceb           -0.0635     0.0397    -1.5973     0.1104     -0.1414      0.0145
monthfm        0.0411     0.0208     1.9734     0.0486      0.0003      0.0819
idlnchld       0.0780     0.0395     1.9742     0.0485      0.0005      0.1555
educ           0.3277     0.0492     6.6603     0.0000      0.2312      0.4241
==============================================================================

Endogenous: educ
Instruments: electric
Robust Covariance (Heteroskedastic)
Debiased: True
Estimated slope for 'educ' in 2SLS regression: 0.328

Question 4

                          IV-2SLS Estimation Summary
==============================================================================
Dep. Variable:               agefbrth   R-squared:                      0.0334
Estimator:                   IV-2SLS   Adj. R-squared:                 0.0313
No. Observations:               1870   F-statistic:                    24.320
Date:                Sun, Dec 10 2023   P-value (F-stat)                0.0000
Time:                        22:34:22   Distribution:                F(4,1865)
Cov. Estimator:                robust

                             Parameter Estimates
==============================================================================
            Parameter  Std. Err.     T-stat    P-value    Lower CI    Upper CI
------------------------------------------------------------------------------
Intercept      17.676     0.4847     36.464     0.0000      16.725      18.626
ceb           -0.0939     0.0392    -2.3942     0.0168     -0.1709     -0.0170
monthfm        0.0412     0.0205     2.0110     0.0445      0.0010      0.0815
idlnchld       0.0501     0.0381     1.3136     0.1891     -0.0247      0.1248
educ           0.2655     0.0481     5.5197     0.0000      0.1711      0.3598
==============================================================================

Endogenous: educ
Instruments: electric, urban
Robust Covariance (Heteroskedastic)
Debiased: True

Estimated slope for 'educ' with multiple instruments: 0.265

Wooldridge's score test of overidentification
H0: Model is not overidentified.
Statistic: 29.9033
P-value: 0.0000
Distributed: chi2(1)
(base) divitshetty@Divits-MBP-2 A5 %
```

Python Program Text

Question 1

Estimated slope for 'educ': **0.1306 (0.131)**

Question 2

Question 2(a)

- **Formula:** educ ~ ceb + monthfm + idlnchld + electric

Question 2(b)

- Robust t-stat: **18.322**
- Corresponding p-value: **0.000**

Question 3 (Pt.1)

Question 3(a)

- formula='agefbrth ~ educ + educ_resid + ceb + monthfm + idlnchld'

Question 3(b)

- Robust t stat: **4.38e+15**
- Corresponding p-value: **0.000**

Question 3 (Pt.2)

Estimated slope for 'educ' in 2SLS regression with ‘electric’ as instrument: **0.328**

Question 4

Question 4(a)

- Estimated slope for 'educ' in 2SLS regression with multiple instruments: **0.265**

Question 4(b)

- **Wooldridge's score test of overidentification**
  - H0: Model is not overidentified.
  - Statistic: 29.9033
  - P-value: 0.0000
  - Distributed: chi2(1)
- **Because of the high test stat (29.9) and the low p-value, we reject the null hypothesis(H0).**
  - **Thus, conclude that this model is overidentified.**