Program Evaluation Toolkit

Chapter 2

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Data Analysis Examples

Module 7 Data Analysis

Data Analysis Examples

- Two relatively straightforward examples of data analysis, presented in relation to the fictitious AMMP! evaluation.
- The examples are aligned to specific AMMP! evaluation questions.
  - Example 1 – Quantitative example
  - Example 2 – Qualitative example

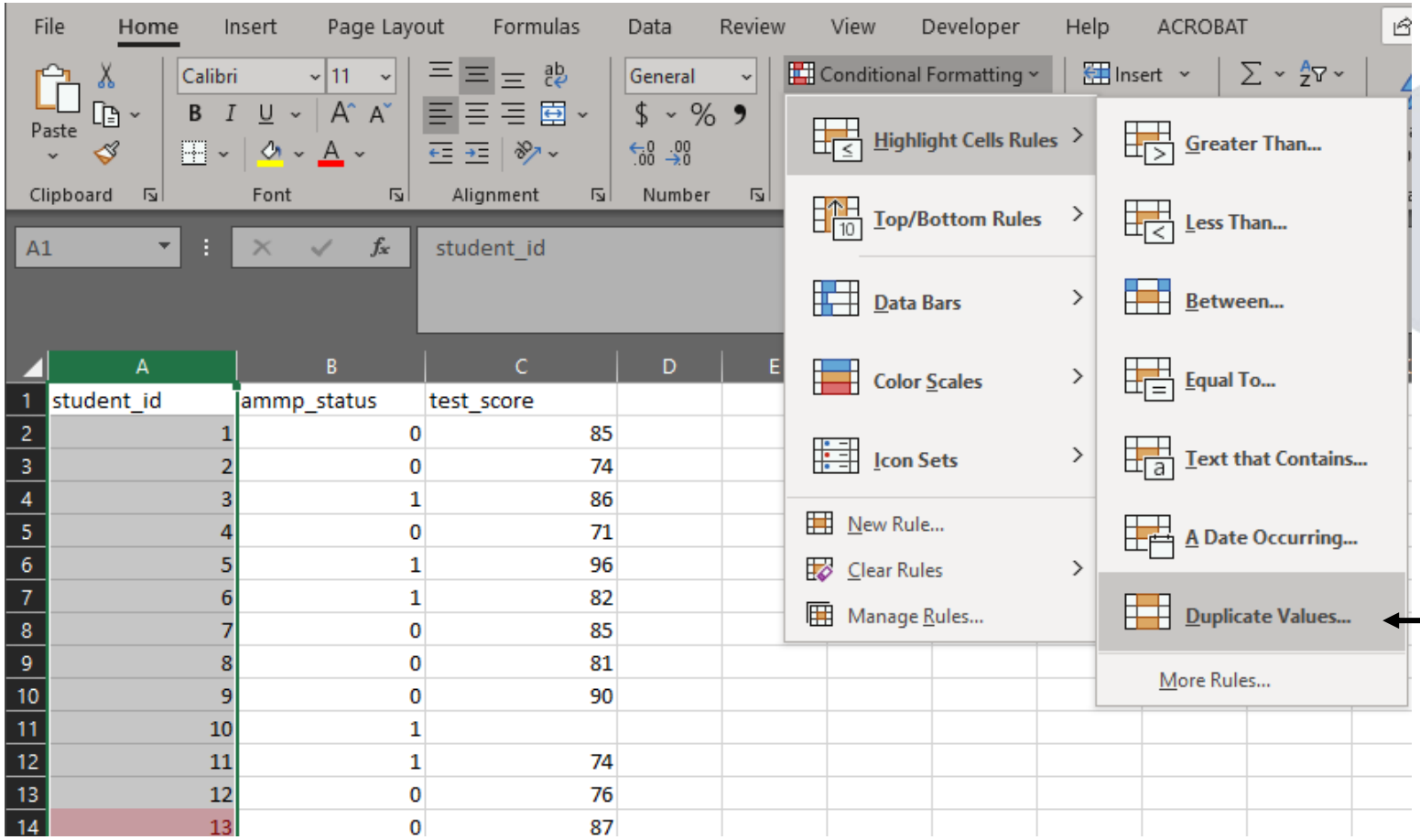
Data Analysis: Quantitative Example

- Consider the following AMMP! evaluation question:
  - How do AMMP! participants' scores on high school math placement tests compare to nonparticipants' scores?
- This question involves examining test scores; therefore, a quantitative method is more suitable to addressing the question.

Data Cleaning

- Do the data contain duplicates?
- Do the data contain missing values?
- Are there entry errors?
- Are there outliers?

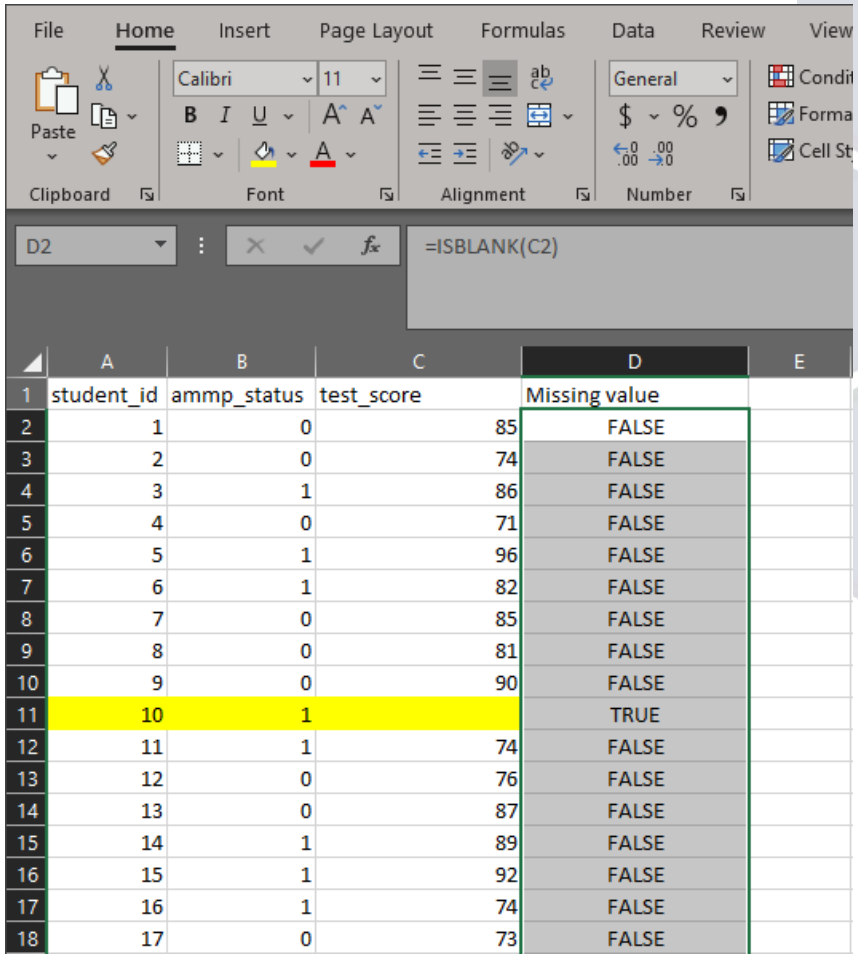
Removing Duplicates



	A	B	C	D	E
1	student_id	ammp_status	test_score		
2	1	0	85		
3	2	0	74		
4	3	1	86		
5	4	0	71		
6	5	1	96		
7	6	1	82		
8	7	0	85		
9	8	0	81		
10	9	0	90		
11	10	1			
12	11	1	74		
13	12	0	76		
14	13	0	87		

Examining Missing Values

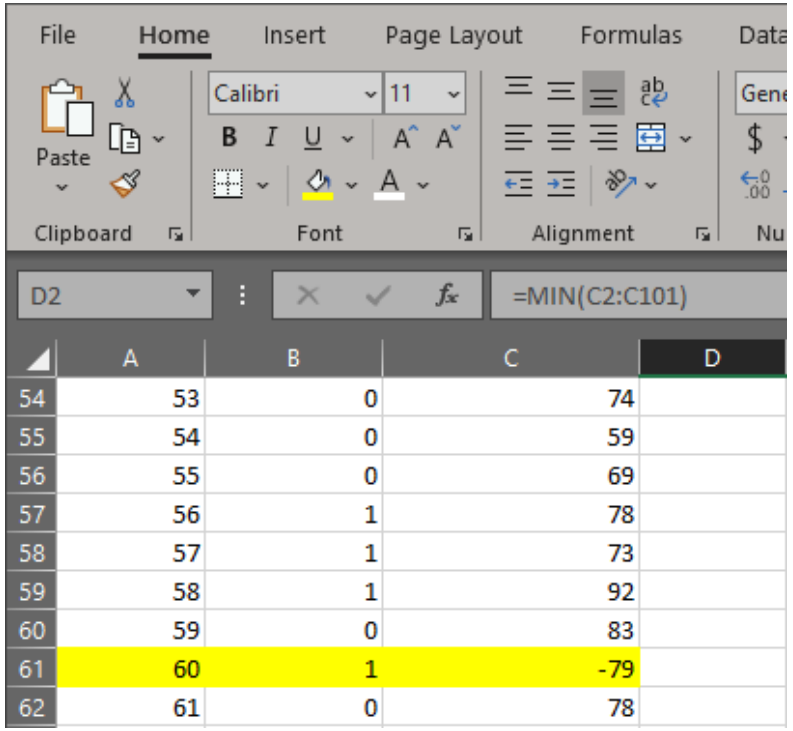
- =ISBLANK(C2)



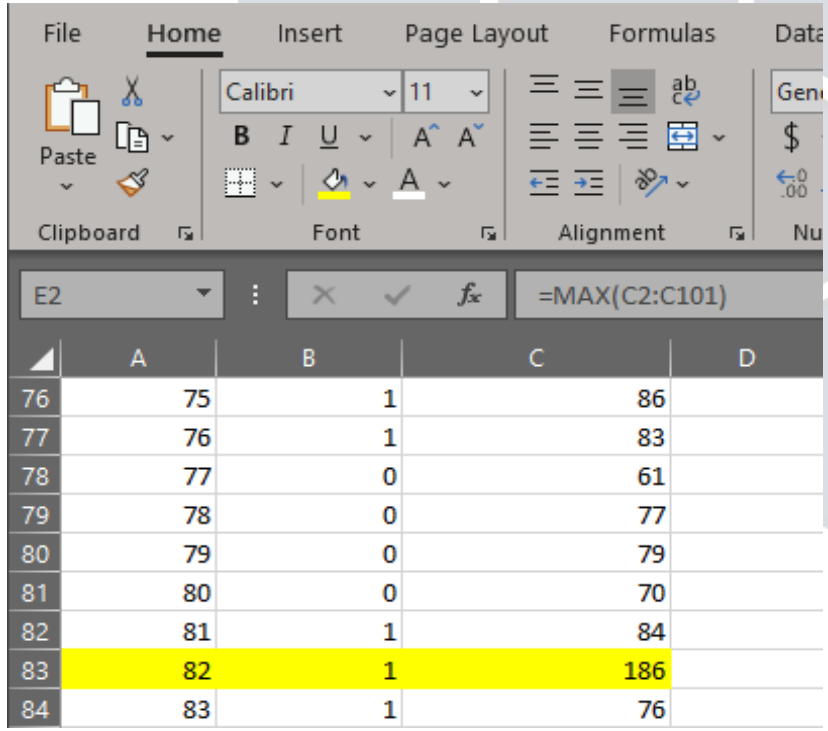
	A	B	C	D	E
1	student_id	ammp_status	test_score	Missing value	
2	1	0	85	FALSE	
3	2	0	74	FALSE	
4	3	1	86	FALSE	
5	4	0	71	FALSE	
6	5	1	96	FALSE	
7	6	1	82	FALSE	
8	7	0	85	FALSE	
9	8	0	81	FALSE	
10	9	0	90	FALSE	
11	10	1		TRUE	
12	11	1	74	FALSE	
13	12	0	76	FALSE	
14	13	0	87	FALSE	
15	14	1	89	FALSE	
16	15	1	92	FALSE	
17	16	1	74	FALSE	
18	17	0	73	FALSE	

Cleaning Data Entry Errors

- =MIN(C2:C101)
- =MAX(C2:C101)



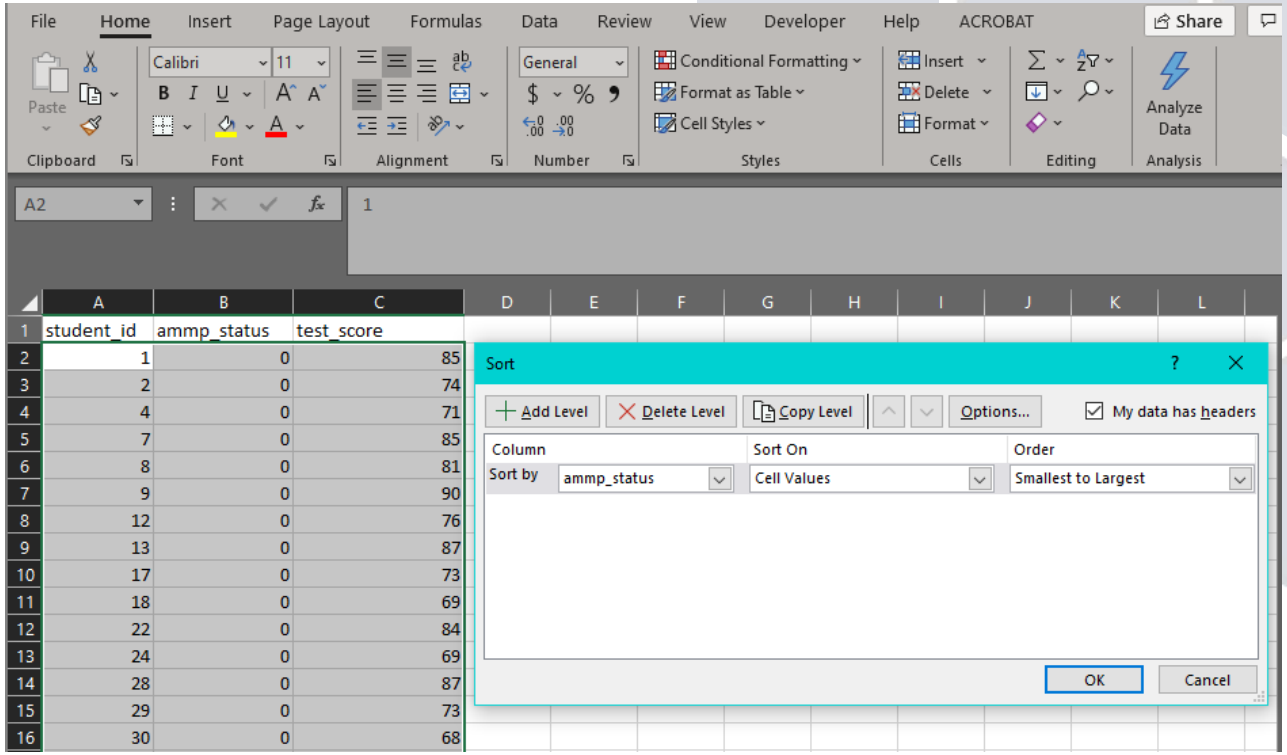
	A	B	C	D
54	53	0	74	
55	54	0	59	
56	55	0	69	
57	56	1	78	
58	57	1	73	
59	58	1	92	
60	59	0	83	
61	60	1	-79	
62	61	0	78	



	A	B	C	D
76	75	1	86	
77	76	1	83	
78	77	0	61	
79	78	0	77	
80	79	0	79	
81	80	0	70	
82	81	1	84	
83	82	1	186	
84	83	1	76	

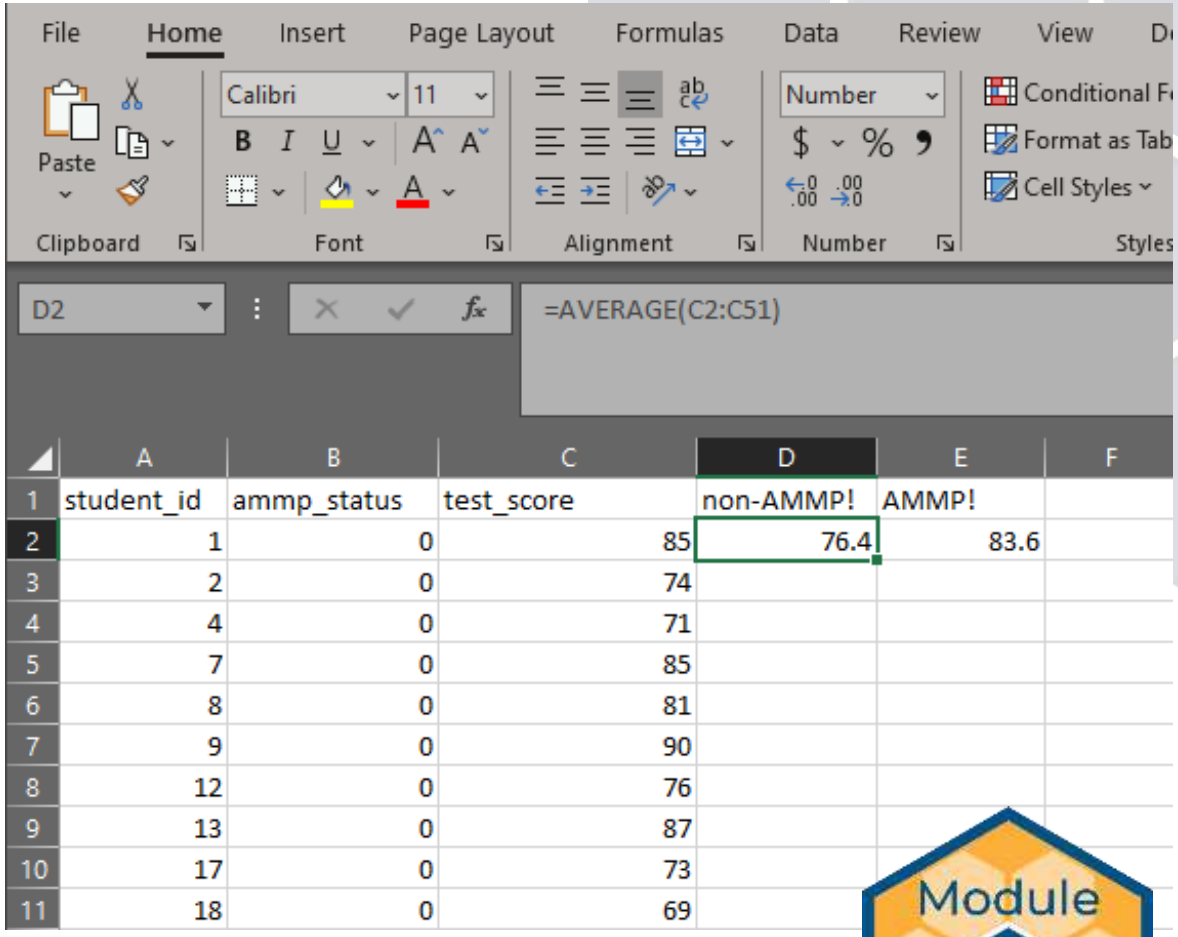
Descriptive Statistics

- Sort data for comparing AMMP! students and non-AMMP! students



Descriptive Statistics: Mean

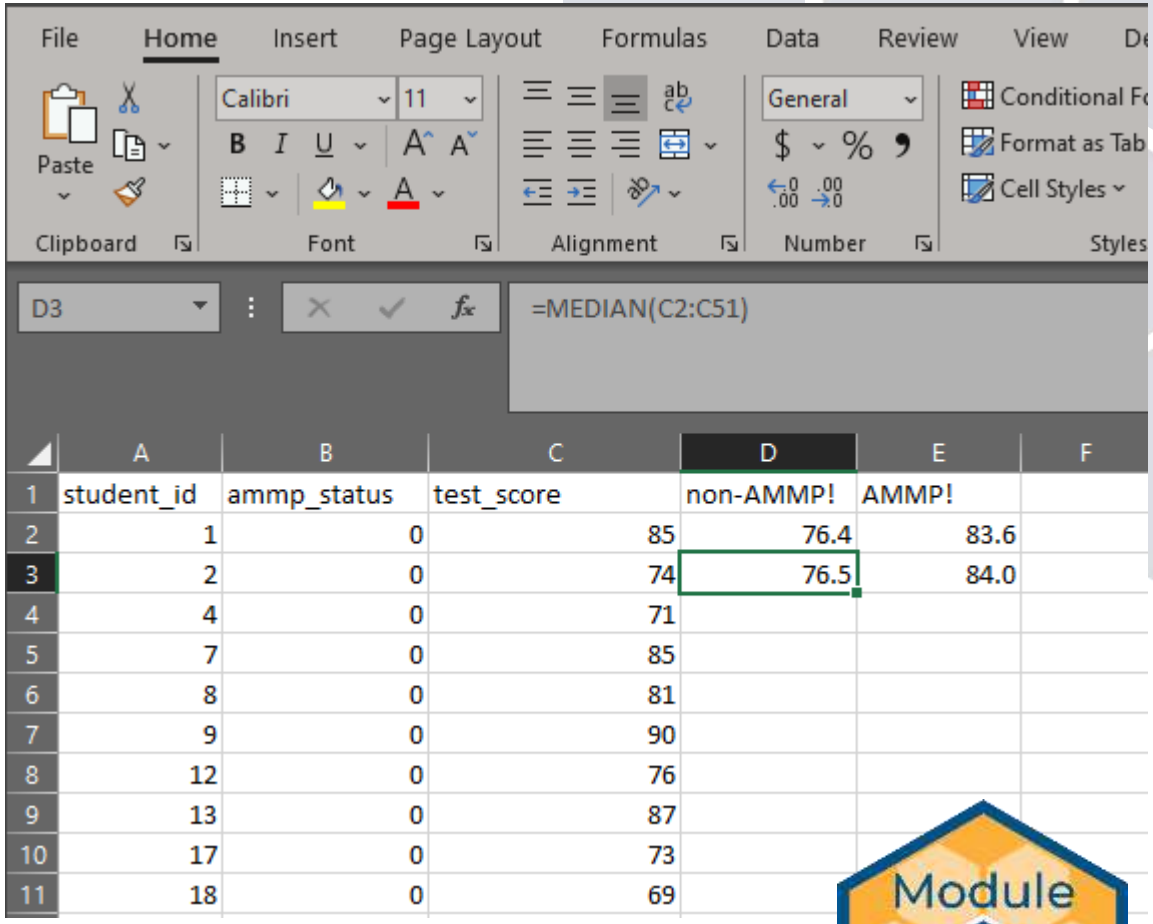
- =AVERAGE(C2:C51)
- =AVERAGE(C52:C101)



	A	B	C	D	E	F
1	student_id	ammp_status	test_score	non-AMMP!	AMMP!	
2	1	0	85	76.4	83.6	
3	2	0	74			
4	4	0	71			
5	7	0	85			
6	8	0	81			
7	9	0	90			
8	12	0	76			
9	13	0	87			
10	17	0	73			
11	18	0	69			

Descriptive Statistics: Median

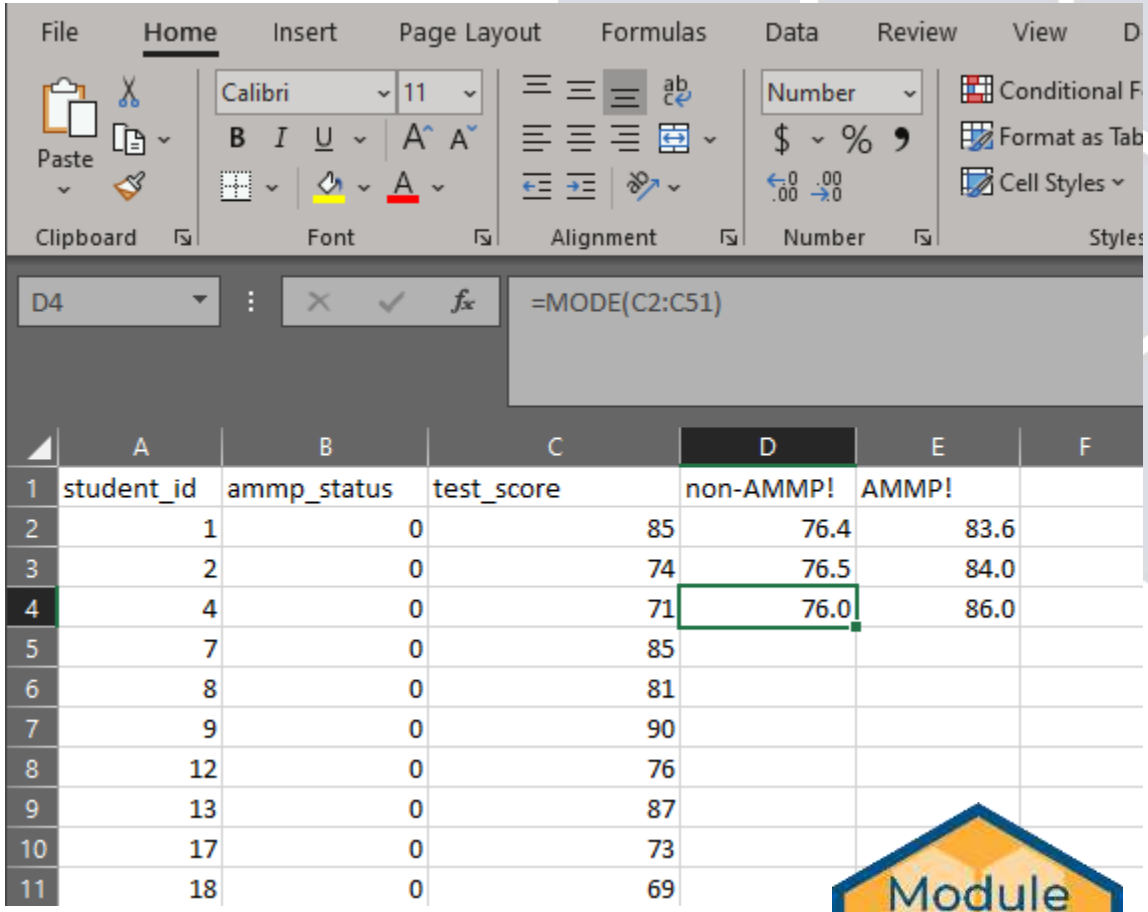
- =MEDIAN(C2:C51)
- =MEDIAN(C52:C101)



	A	B	C	D	E	F
1	student_id	ammp_status	test_score	non-AMMP!	AMMP!	
2	1	0	85	76.4	83.6	
3	2	0	74	76.5	84.0	
4	4	0	71			
5	7	0	85			
6	8	0	81			
7	9	0	90			
8	12	0	76			
9	13	0	87			
10	17	0	73			
11	18	0	69			

Descriptive Statistics: Mode

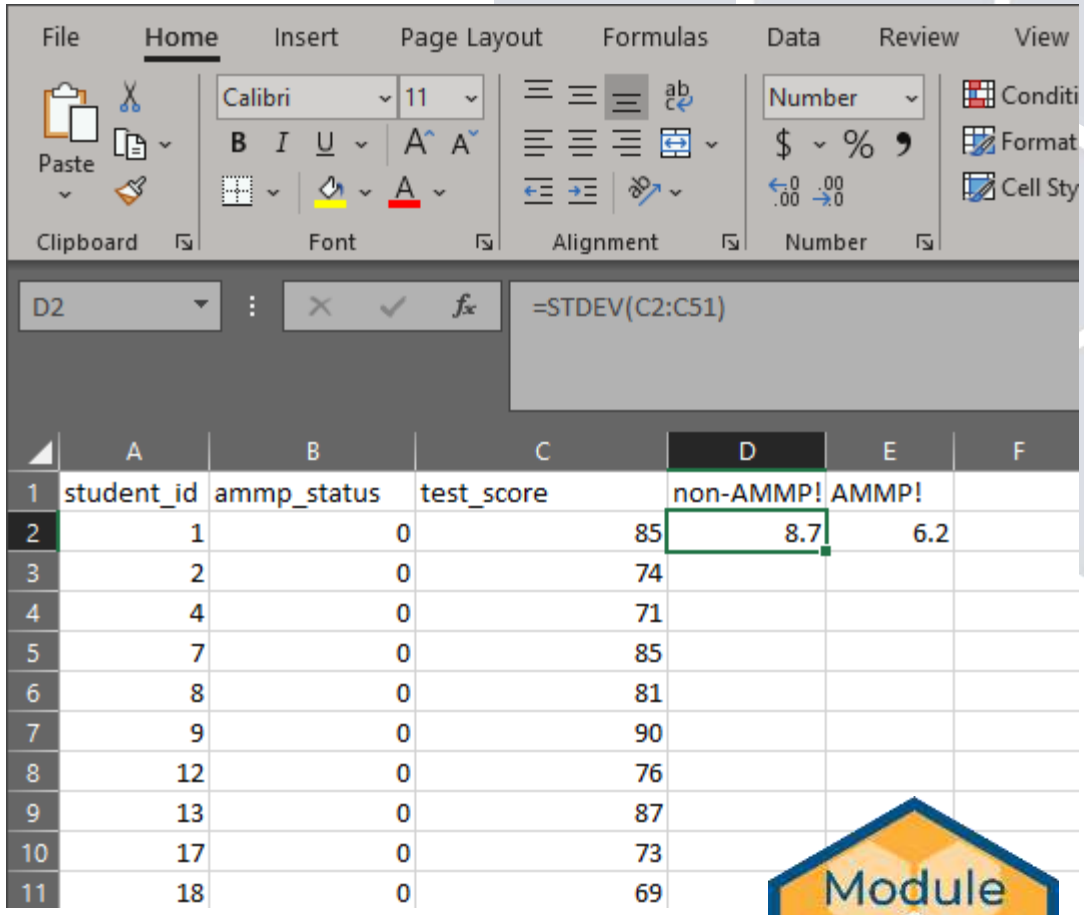
- =MODE(C2:C51)
- =MODE(C52:C101)



	A	B	C	D	E	F
1	student_id	ammp_status	test_score	non-AMMP!	AMMP!	
2	1	0	85	76.4	83.6	
3	2	0	74	76.5	84.0	
4	4	0	71	76.0	86.0	
5	7	0	85			
6	8	0	81			
7	9	0	90			
8	12	0	76			
9	13	0	87			
10	17	0	73			
11	18	0	69			

Descriptive Statistics: Standard Deviation

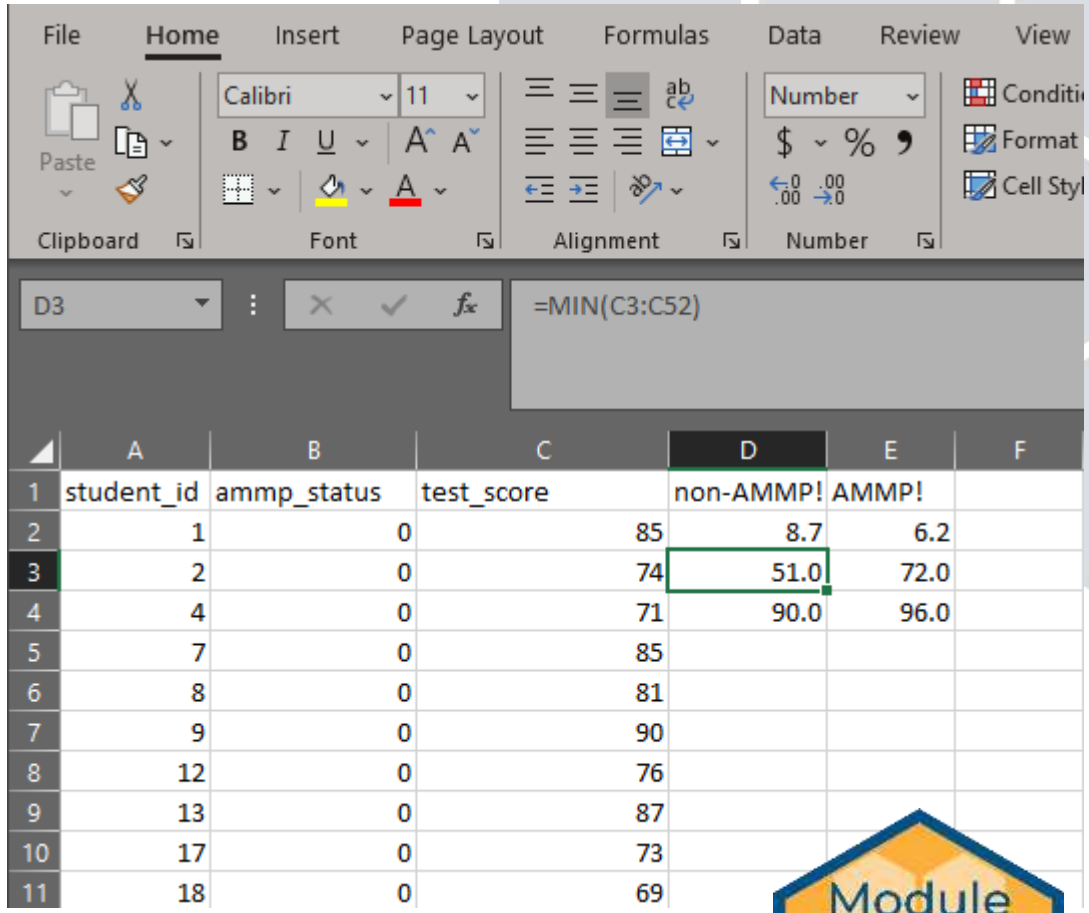
- =STDEV(C2:C51)
- =STDEV(C52:C101)



	A	B	C	D	E	F
1	student_id	ammp_status	test_score	non-AMMP!	AMMP!	
2	1	0	85	8.7	6.2	
3	2	0	74			
4	4	0	71			
5	7	0	85			
6	8	0	81			
7	9	0	90			
8	12	0	76			
9	13	0	87			
10	17	0	73			
11	18	0	69			

Descriptive Statistics: Minimum, Maximum, and Range

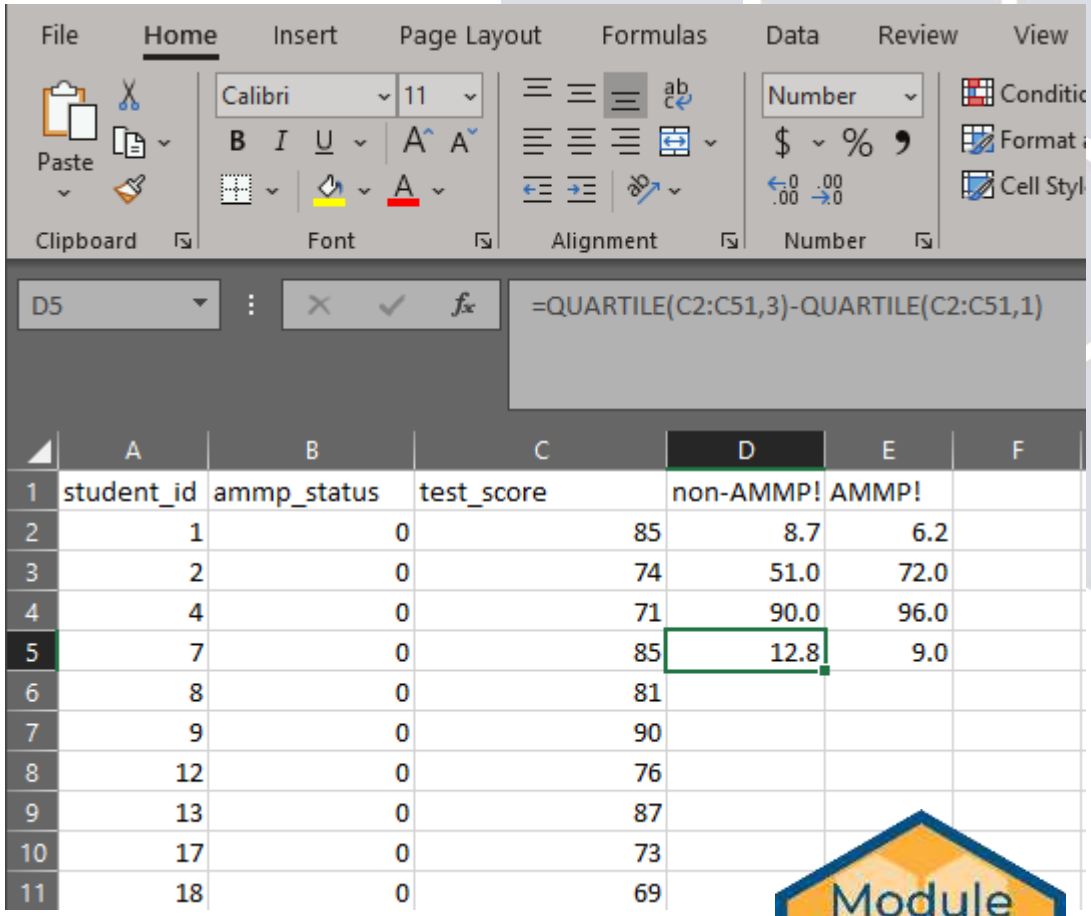
- =MIN(C2:C51)
- =MAX(C2:C51)
- =MIN(C52:C101)
- =MAX(C52:C101)



	A	B	C	D	E	F
1	student_id	ammp_status	test_score	non-AMMP!	AMMP!	
2	1	0	85	8.7	6.2	
3	2	0	74	51.0	72.0	
4	4	0	71	90.0	96.0	
5	7	0	85			
6	8	0	81			
7	9	0	90			
8	12	0	76			
9	13	0	87			
10	17	0	73			
11	18	0	69			

Descriptive Statistics: Interquartile Range

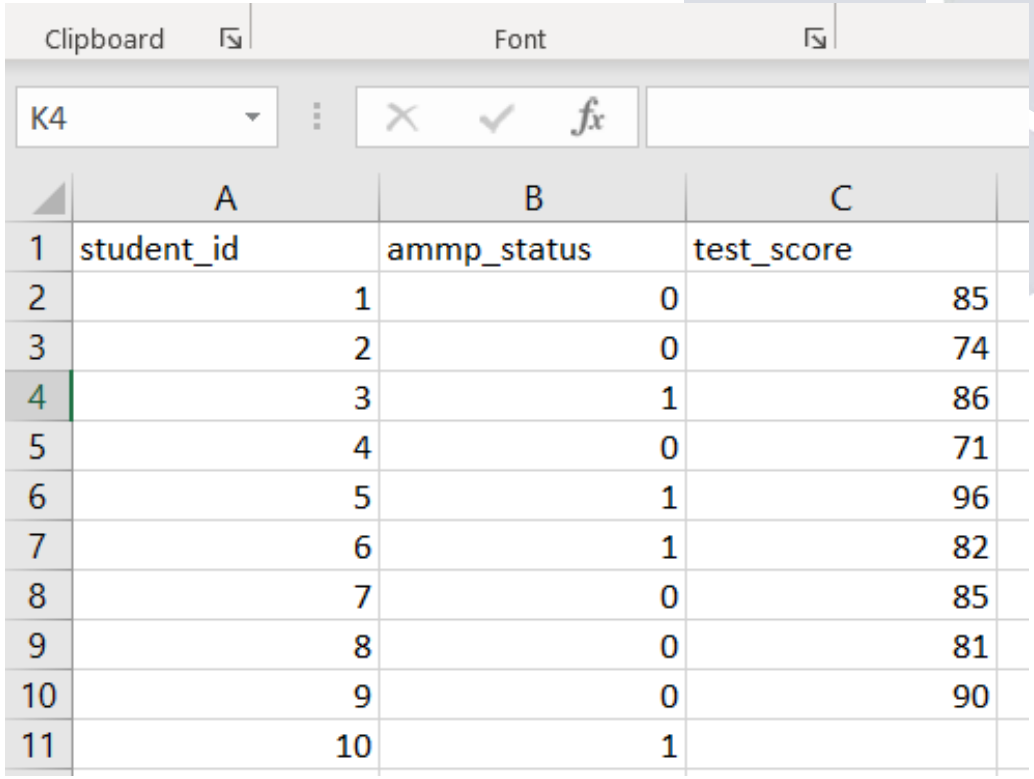
- =QUARTILE(C2:C51,3)-QUARTILE(C2:C51,1)
- =QUARTILE(C52:C101,3)-QUARTILE(C52:C101,1)



	A	B	C	D	E	F
1	student_id	ammp_status	test_score	non-AMMP!	AMMP!	
2	1	0	85	8.7	6.2	
3	2	0	74	51.0	72.0	
4	4	0	71	90.0	96.0	
5	7	0	85	12.8	9.0	
6	8	0	81			
7	9	0	90			
8	12	0	76			
9	13	0	87			
10	17	0	73			
11	18	0	69			

Descriptive Statistics Using the Toolkit Calculator

- Central tendency:
  - Mean
  - Median
  - Mode
- Variation:
  - Standard deviation
  - Minimum
  - Maximum
  - Interquartile range



	A	B	C
1	student_id	ammp_status	test_score
2	1	0	85
3	2	0	74
4	3	1	86
5	4	0	71
6	5	1	96
7	6	1	82
8	7	0	85
9	8	0	81
10	9	0	90
11	10	1	

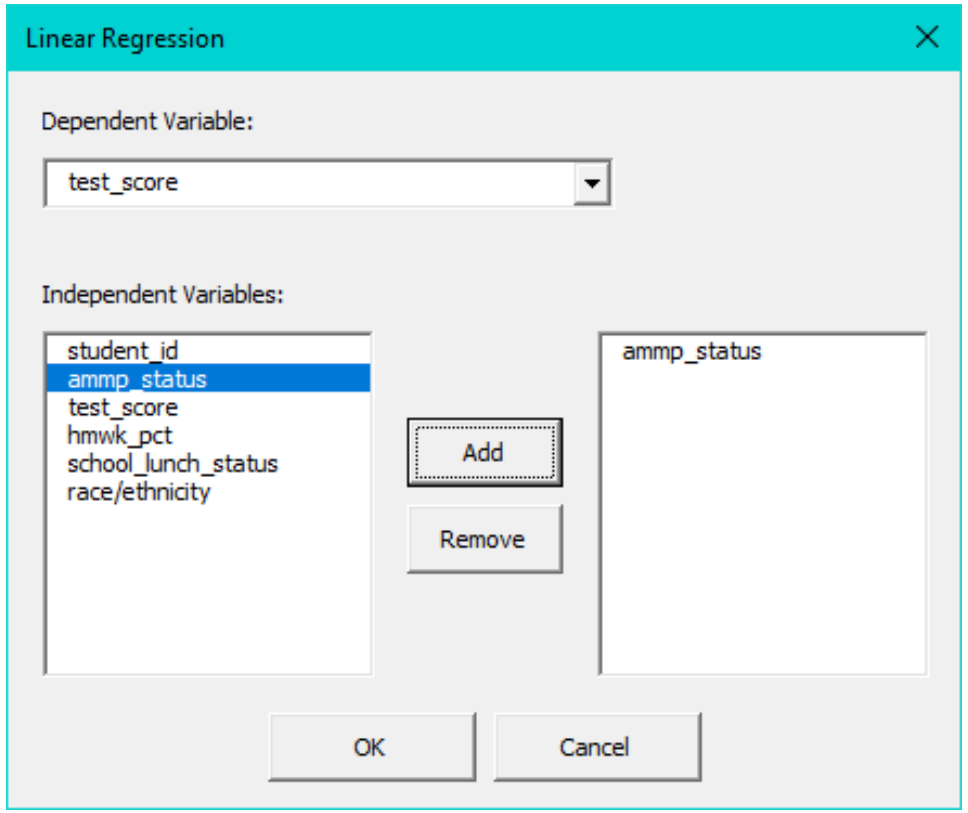
Additional Resources

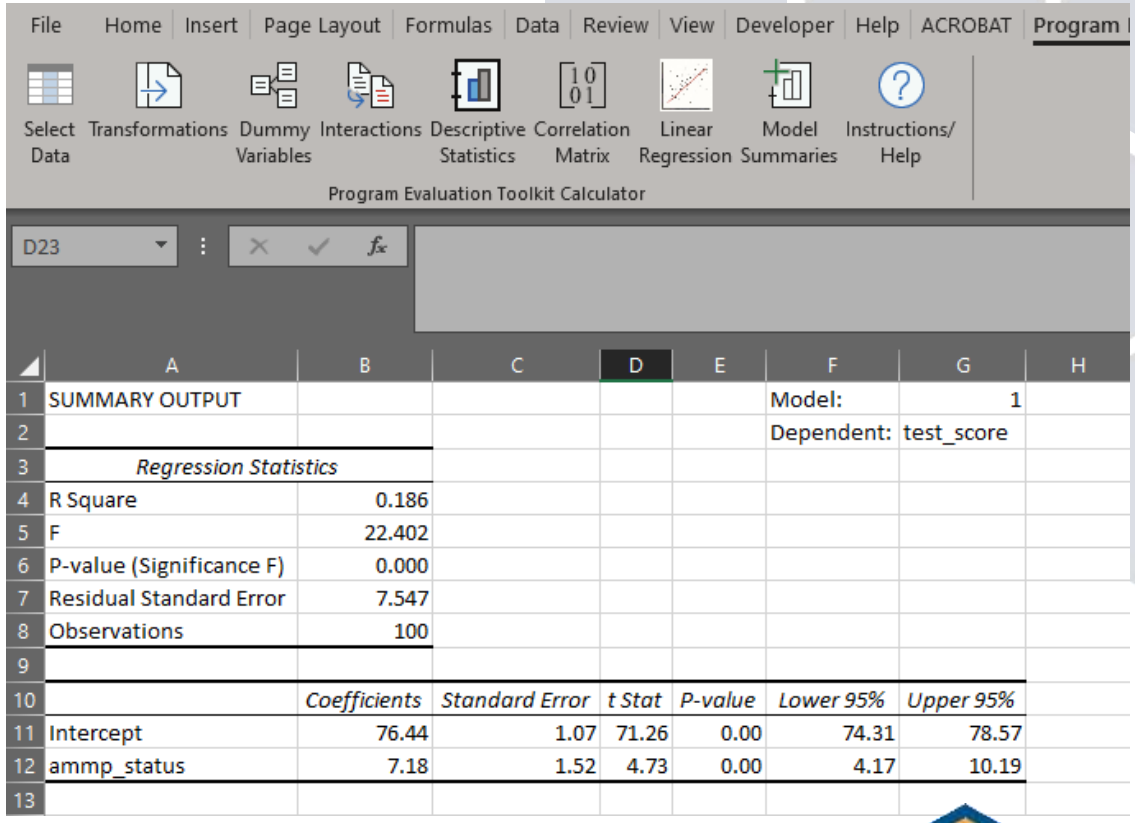
- *Program Evaluation Toolkit Calculator*
- *Program Evaluation Toolkit Calculator: User's Guide*

Inferential Statistics

- Dependent variable: high school math placement test score
- Independent variable: AMMP! participation
- Possible covariates: homework completion percentage, eligibility for the National School Lunch Program, sex, and race/ethnicity
- Possible confounds?
  - Adjust for confounds using multiple regression.
  - If there are unmeasured confounds, results may not be trustworthy.
  - Only adjust for variables that were measured before student exposure to the program (in this case, AMMP!).

Linear Regression Analysis





	A	B	C	D	E	F	G	H
1	SUMMARY OUTPUT					Model:	1	
2						Dependent:	test_score	
3	*Regression Statistics*							
4	R Square	0.186						
5	F	22.402						
6	P-value (Significance F)	0.000						
7	Residual Standard Error	7.547						
8	Observations	100						
9								
10		*Coefficients*	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	
11	Intercept	76.44	1.07	71.26	0.00	74.31	78.57	
12	ammp_status	7.18	1.52	4.73	0.00	4.17	10.19	
13								

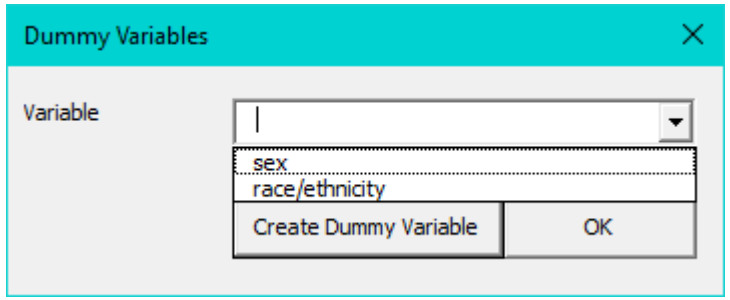
Additional Resources

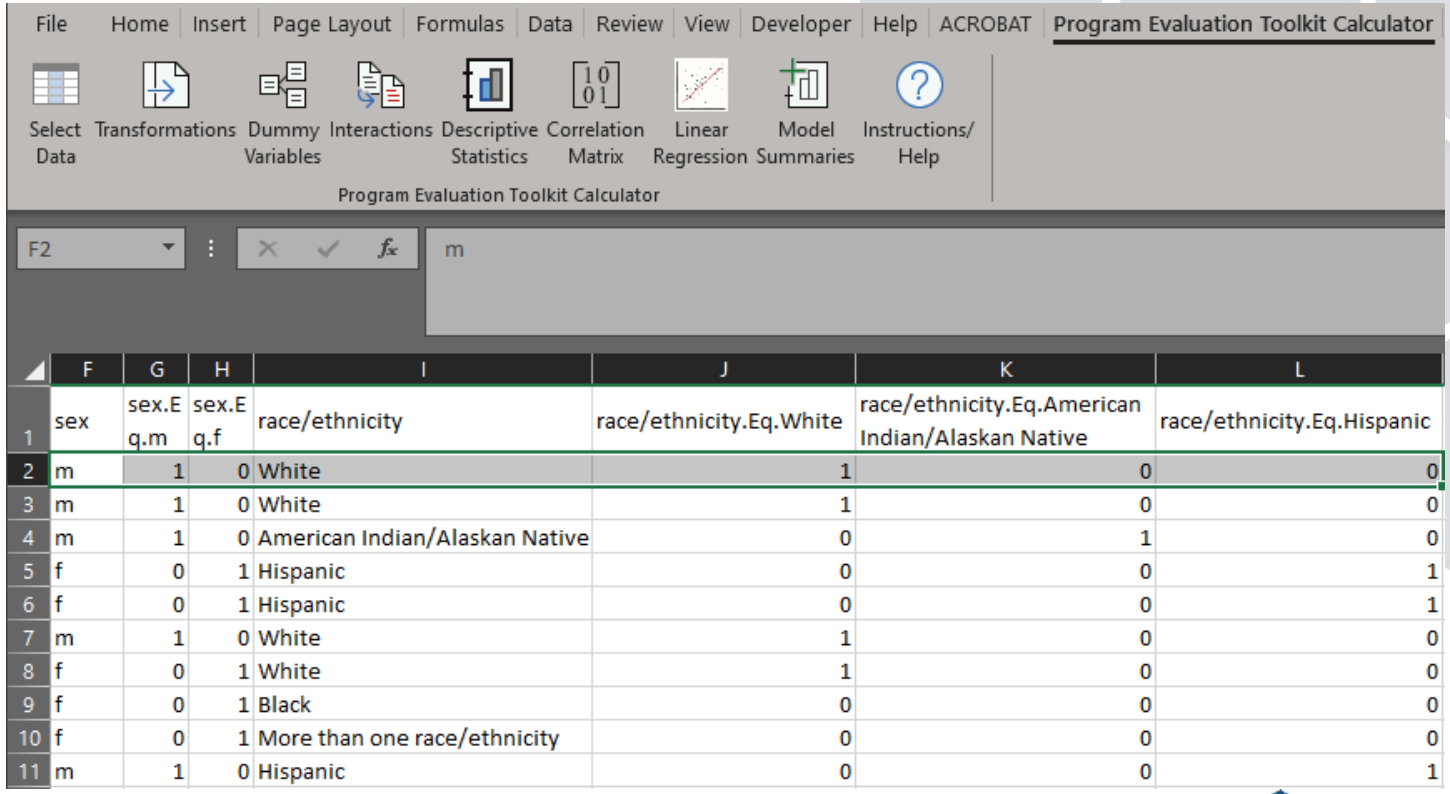
- *Program Evaluation Toolkit Calculator*
- *Program Evaluation Toolkit Calculator: User's Guide*

Interpretation: Regression Coefficients[1]

- The intercept coefficient is the predicted value of the dependent variable when the independent variables are all 0.
  - For example, the average test score for non-AMMP! students.
- The coefficients for the independent variables indicate the predicted change in the dependent variable when an independent variable increases by one unit.
  - For example, the "ammp_status" coefficient is the difference between the average test score of AMMP! students and that of non-AMMP! students.
  - On average, AMMP! students scored 7.18 points higher than non-AMMP! students scored on the math placement exam.

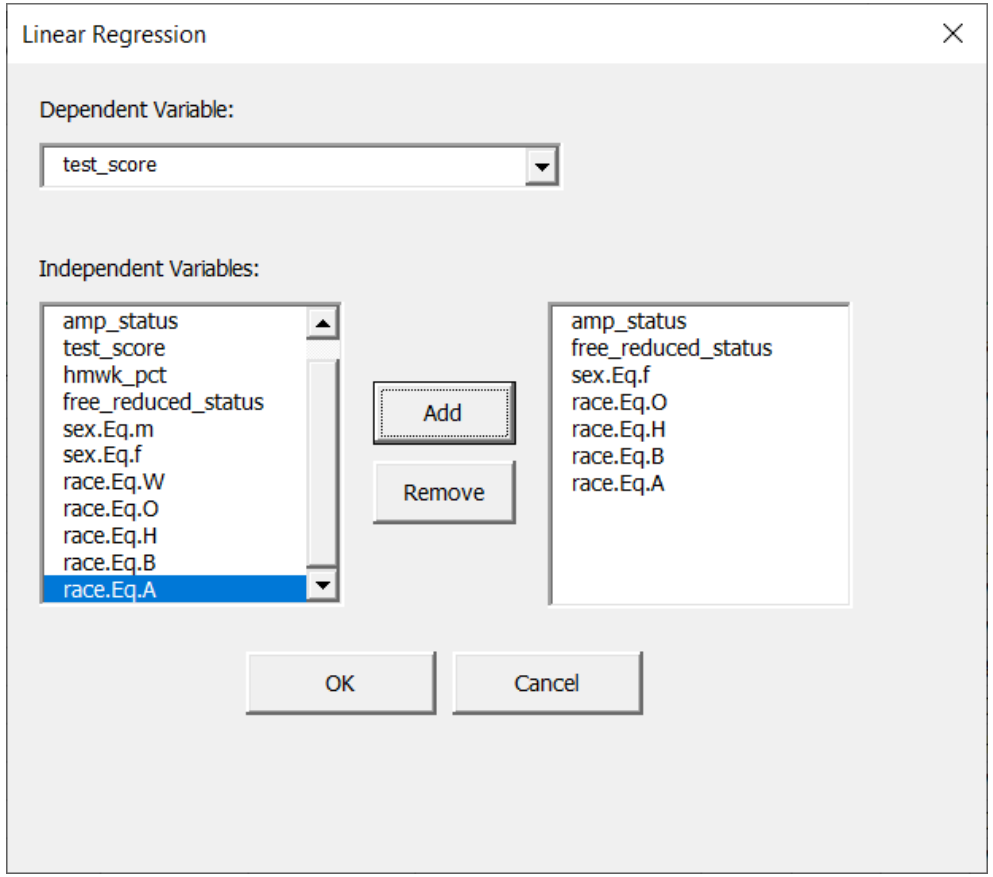
Multiple Regression Analysis[1]

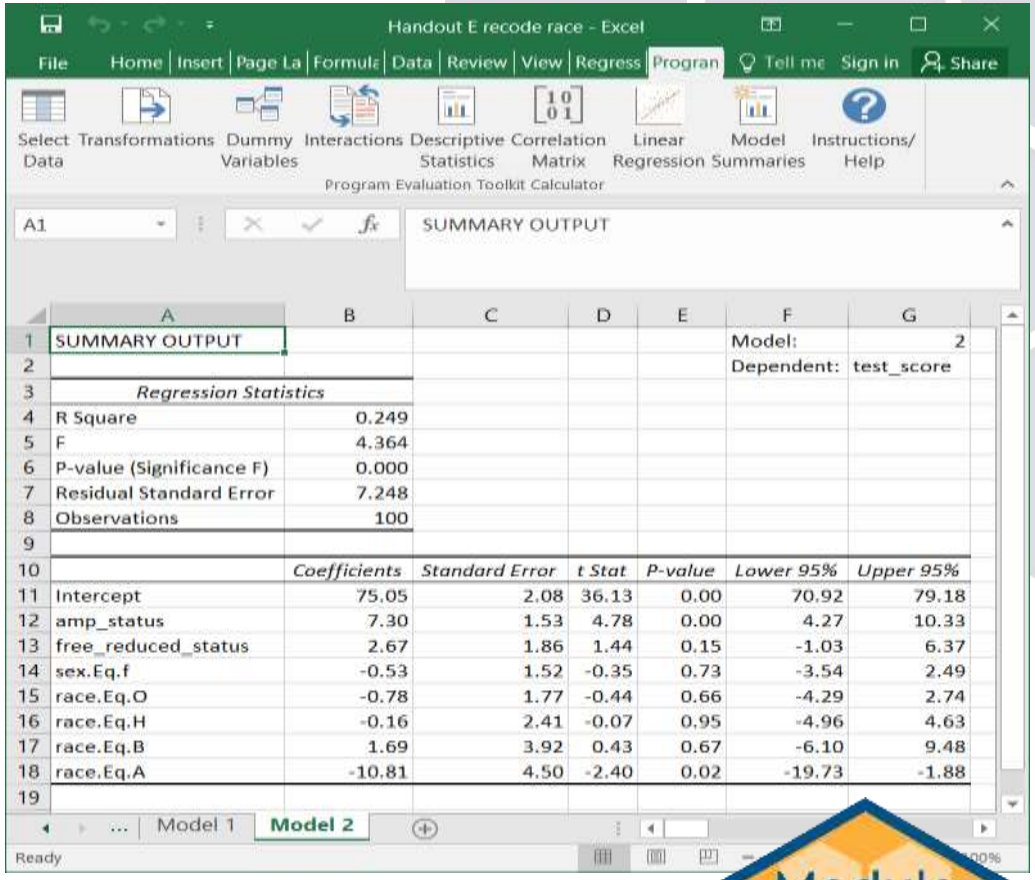




	F	G	H	I	J	K	L
1	sex	sex.Eq.m	sex.Eq.f	race/ethnicity	race/ethnicity.Eq.White	race/ethnicity.Eq.American Indian/Alaskan Native	race/ethnicity.Eq.Hispanic
2	m	1	0	White	1	0	0
3	m	1	0	White	1	0	0
4	m	1	0	American Indian/Alaskan Native	0	1	0
5	f	0	1	Hispanic	0	0	1
6	f	0	1	Hispanic	0	0	1
7	m	1	0	White	1	0	0
8	f	0	1	White	1	0	0
9	f	0	1	Black	0	0	0
10	f	0	1	More than one race/ethnicity	0	0	0
11	m	1	0	Hispanic	0	0	1

Multiple Regression Analysis: Results





	A	B	C	D	E	F	G
1	SUMMARY OUTPUT					Model:	2
2						Dependent:	test_score
3	*Regression Statistics*						
4	R Square	0.249					
5	F	4.364					
6	P-value (Significance F)	0.000					
7	Residual Standard Error	7.248					
8	Observations	100					
9							
10		*Coefficients*	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
11	Intercept	75.05	2.08	36.13	0.00	70.92	79.18
12	amp_status	7.30	1.53	4.78	0.00	4.27	10.33
13	free_reduced_status	2.67	1.86	1.44	0.15	-1.03	6.37
14	sex.Eq.f	-0.53	1.52	-0.35	0.73	-3.54	2.49
15	race.Eq.O	-0.78	1.77	-0.44	0.66	-4.29	2.74
16	race.Eq.H	-0.16	2.41	-0.07	0.95	-4.96	4.63
17	race.Eq.B	1.69	3.92	0.43	0.67	-6.10	9.48
18	race.Eq.A	-10.81	4.50	-2.40	0.02	-19.73	-1.88
19							

Data Analysis: Qualitative Example[2]

- Consider the following AMMP! evaluation question:
  - What barriers exist that prevent students from completing homework?
- This question likely involves complex subjective judgments for which complete quantitative data do not exist or cannot be easily collected.
  - It is more appropriate to address the question with qualitative data.

Qualitative Analysis Activity

- Interview question for students:
  - What are some things that might keep you from completing homework?
- Interview question for teachers:
  - What do you think are barriers that prevent students from completing homework?
- Identify common themes in the mock responses to the questions.

Common Themes

- Lack of time
- Unsupervised time after school
- Difficulty of homework
- Not seeing the value of homework

Additional Resources[3]

- *Statistical Theory for the* RCT-YES *Software: Design-Based Causal Inference for RCTs* provides support in conducting rigorously designed evaluations.
- Evidence to Insights (e2i) Coach is a free online tool that can help you generate evidence related to programs implemented in your specific context.

Program Evaluation Toolkit

Module 7 Data Analysis

Chapter 2 Complete

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Recommended next: Chapter 3 – From Results to Interpretation to Recommendations

Thank You

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and for access to our many free resources.

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RELCentral@marzanoresearch.com

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References

1. Glass, G. V., & Hopkins, K. D. (1995). *Statistical methods in education and psychology* (3rd ed.). Allyn & Bacon.
2. Creswell, J. W., & Poth, C. N. (2016). *Qualitative inquiry and research design: Choosing among five approaches* (3rd ed.). Sage.
3. Schochet, P. Z. (2016). *Statistical theory for the* RCT-YES *software: Design-based causal inference for RCTs* (2nd ed.; NCEE 2015–4011). U.S. Department of Education, Institute of Education Sciences, National Center for Education Evaluation and Regional Assistance, Analytic Technical Assistance and Development. https://ies.ed.gov/ncee/pubs/20154011/
4. Mathematica. (n.d.). Evidence to Insights Coach. https://e2icoach.org/