S057: Massachusetts AP diagnostic analysis

Spring 2023 • Due Sunday, April 2, 11:59 pm Eastern

You have seen two examples of diagnostic analyses. Gordon and Conaway, chapter 1 (pp. 1-19) covers how to design a diagnostic analysis, and we used that approach to analyze and expand on the diagnostic process in Fulton County. Now it's time to try one on your own!

You will complete this assignment with your partner. To facilitate blind review, please put your names on a separate last page in your assignment submission. Do not include your names anywhere else in the document.

The policy challenge

Many public high schools in Massachusetts participate in the Advanced Placement (AP) program from the College Board. The AP program provides high school students with access to a college-level curriculum and the opportunity to earn college credit for students who perform well enough on an end-of-course test in nearly 40 subjects such as calculus, U.S. history, English literature and composition, and studio art.

In Massachusetts, about two-thirds of grade 11 and 12 students (the typical grade levels for AP test takers) take at least one AP course in a given year. Students can choose to take an AP course but not the associated AP test, so only about half of Massachusetts students in grades 11 and 12 take any AP tests. About two-thirds of tests taken by Massachusetts high school students earned a 3 or higher—the score typically needed to earn college credit. For tests taken by economically disadvantaged students, **less than 50% are scored at a 3 or higher.**

The state of Massachusetts would like to increase the number and percentage of AP tests taken that are scored at 3 or higher, particularly for economically disadvantaged students. They would like your help in understanding why high schools vary in success on the AP test, both overall and for students from economically disadvantaged backgrounds.

Your task

This assignment has two parts. They should be submitted on Canvas **as a single document**. You should also submit your worksheet or code as a separate document.

PART A: Diagnostic memo
Using the same data set as skills assignments 3 and 4 (Excel, Stata, R), conduct your own diagnostic analysis using the dataset on high schools in the state and **write an 800-word (maximum) memo** to Jeff Riley, the commissioner of elementary and secondary education, summarizing your findings.

Memo: Com. Jeff Riley

Dear Commissioner Riley,

We understand that the state of Massachusetts is interested in increasing the number and percentage of AP tests taken that are scored at 3 or higher, particularly for economically disadvantaged students. We would like to help you understand why high schools vary in success on the AP test.

First of all, it is important to set the scene with equity in mind: In the state at large, the average (mean) passing rate for tests taken by students with economic disadvantages and students without economic disadvantages differs. (See Data Visualization A below.)

Data Visualization A
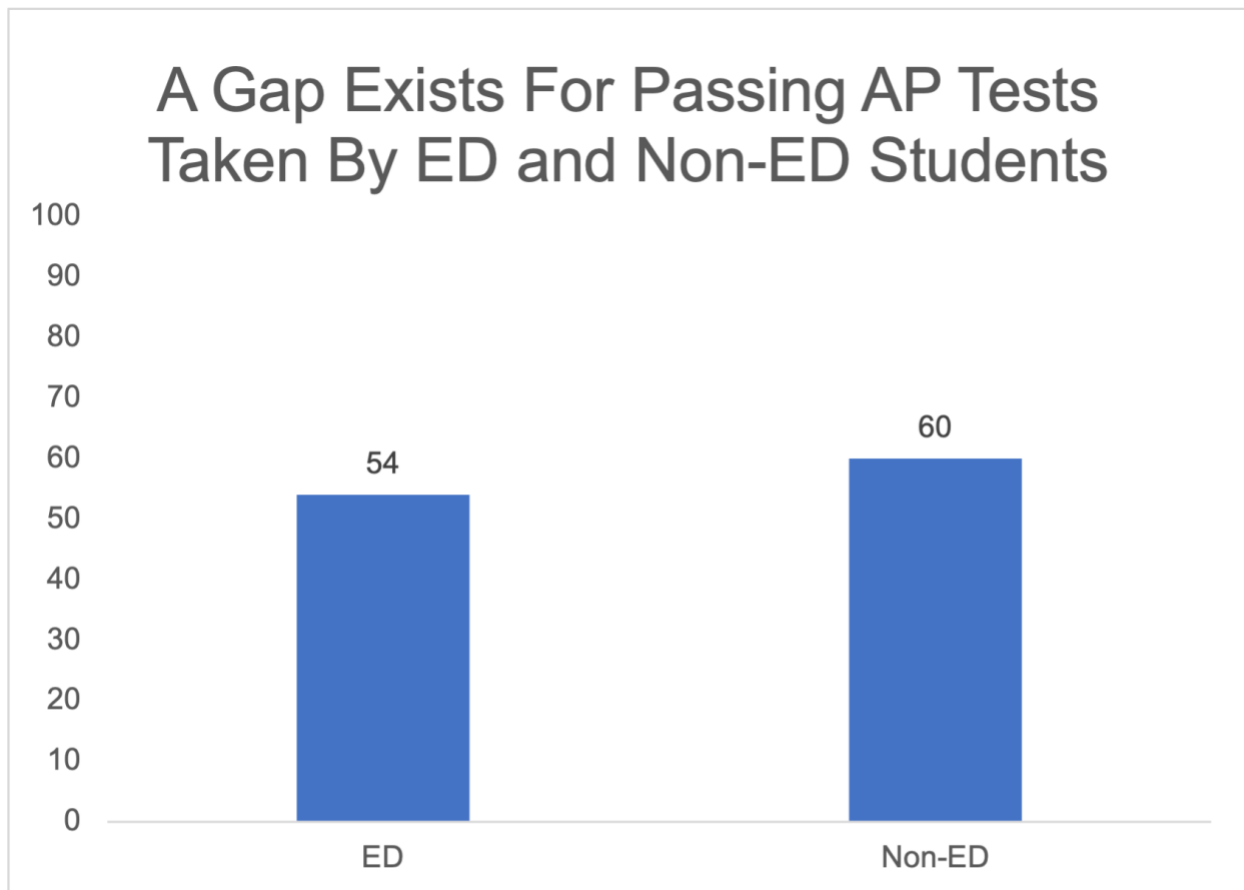
This represents a difference of six percentage points: Tests taken by students without economic disadvantages (Non-ED) are six percent more likely to get a three or higher. The difference between a three and a two on an AP test can be the difference between receiving college credit, enabling students to save money on their path to a college degree. An average

college class costs about $311.00[1] for four credit hours, so receiving college credit for passing one AP exam represents savings of at least 300.00 per year. These savings multiply for the many students who take more than one AP exam—if they pass four AP exams, they can save up to $1,200! A six-percentage-point difference in test passing rate may seem minor, but looking at the passing rate by individual schools reveals deeper differences across the state.

To determine what school demographics may affect the AP test passing rate, we categorized each public school in Massachusetts by the percentage of eleventh and twelfth graders—the vast majority of students taking AP tests—that have economic disadvantages. Just over half of schools in Massachusetts had a "low" percentage of students with economic disadvantages (0 to 25%). Thus, only looking at results at the state level obscures the performance of schools with a higher percentage of students with economic disadvantages. Calculating the mean AP test passing rate for these three categories revealed that where students with economic disadvantages take an AP exam has a startling difference on the likelihood that they will pass the exam. (See Data Visualization B)

Data Visualization B
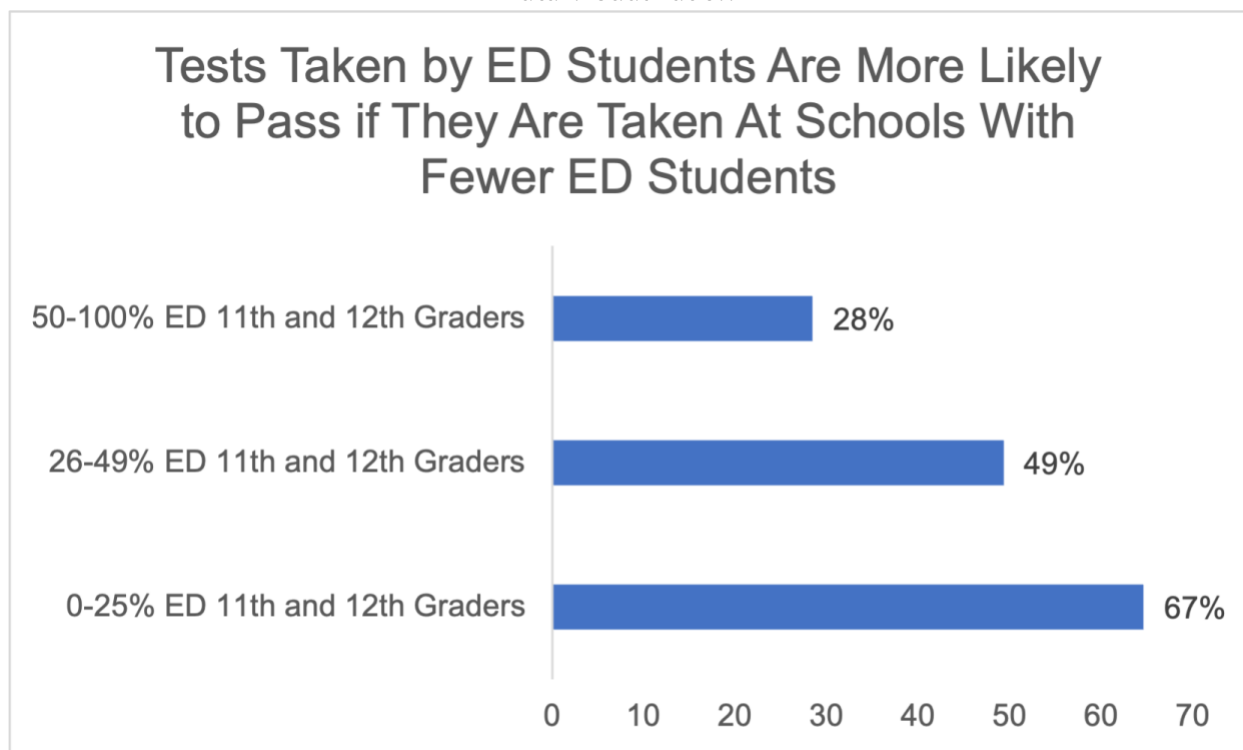
A student with economic disadvantages taking the AP exam, which is the same content regardless of where it is administered, may be 39% less likely to pass if they take the test at a

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[1] Welding, L. *How Much Does College Cost?* https://www.bestcolleges.com/research/average-cost-of-college/ Retrieved March 30, 2023.
(Math: 9,349.00/year / 30 units/year= 311.64/ class/ year.)

Title I school (a school with half or more of its student body having economic disadvantages) versus a school with a wealthier student body. This state of affairs is unacceptable, especially because AP exams can be a gateway to postsecondary education: a crucial component in socioeconomic upwards mobility. Without a college degree, about half of children born in the lowest quintile of income will stay in that quintile of income. On the other hand, if that same child earns a college degree, they only have a 16% chance of staying in that income bracket and in fact have a 19% chance of moving to the highest quintile of income.[2]

Of course, for a student to pass an AP exam, that student must first take the AP course. However, access to AP courses is not the same across Massachusetts. Comparing the percentage of students with economic disadvantages and the number of AP subjects offered reveals that the more students with economic disadvantages there are in a school, the less likely that the school has a large number of AP subjects—if they have any AP subjects at all. (See Data Visualization C.)

Data Visualization C
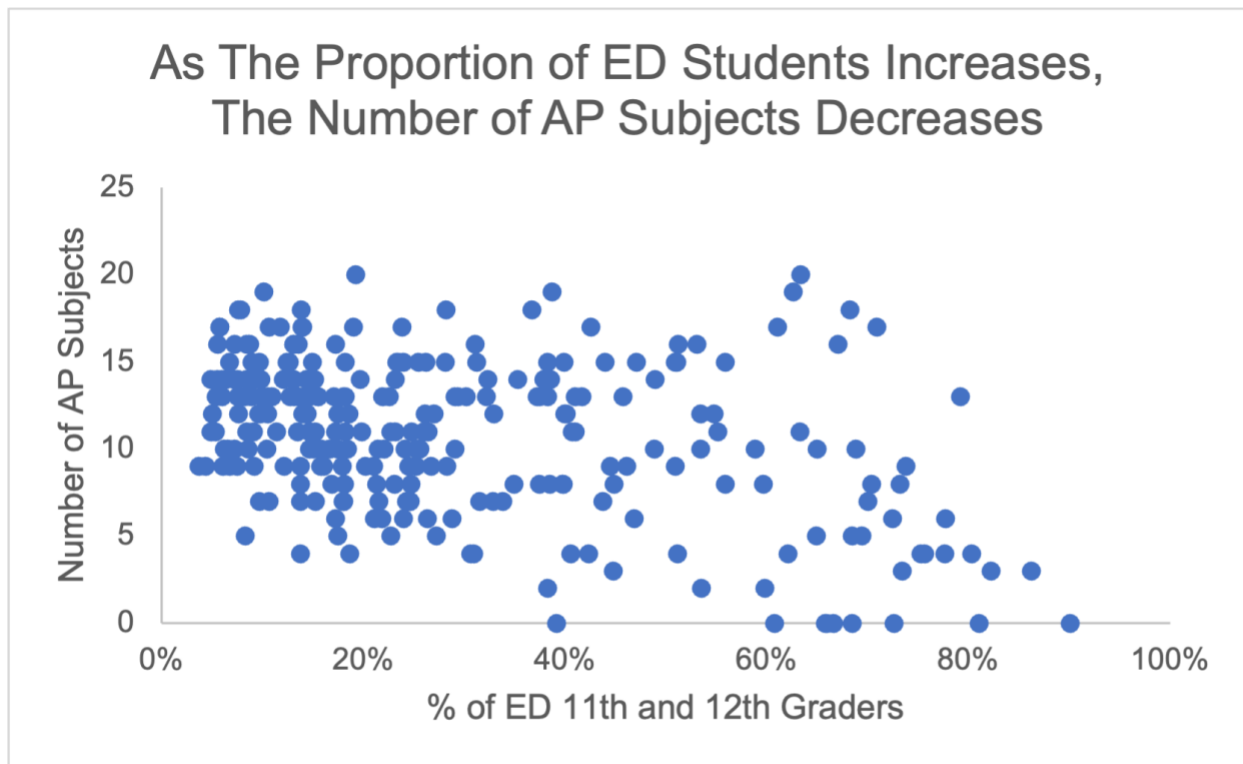
The path to passing an AP exam begins even before the option of what AP classes to take. For instance, there is a positive correlation between passing the English Language Arts (ELA) and Math Massachusetts Comprehensive Assessment System (MCAS) standardized test in grade

[2] Greenstone, M; Looney, A; Patashnik, J; Yu, M (18 November 2016). "Thirteen Economic Facts about Social Mobility and the Role of Education". Brookings Institution. https://www-proquest-com.ezp-prod1.hul.harvard.edu/docview/1792585093?pq-origsite=primo.

10 are more likely to pass their AP exams. The MCAS may represent a "proving ground" for students: a place where their belief that they are "advanced course material" is formed. We as educators must strive to create an environment where as many students believe they are "advanced course material" as possible and all students have access to Advanced Placement (AP) courses and exams.

PART B: Reflection
Write a short reflection about your diagnostic memo, addressing the following questions:
1. How did you select the measures you chose to feature?
2. How did you incorporate the principles of effective data displays into your visualizations?
3. How did the fact that the audience was the commissioner of education affect your writing and design choices?
4. What additional data would you have liked to have had, if any?
5. What did you find most challenging about this assignment? Most rewarding?

The reflection should follow your memo **in the same document**. No strict word limit; we suggest around 250 to 300 words.

1.
We selected our measures to feature by looking at the gestalt data Excel sheet and by narrowing down the two groups we were interested in comparing: economic and noneconomic disadvantaged students. Further, we chose to discuss that economically disadvantaged students are the ones who will most likely benefit from having the opportunity to take the AP exams in order to receive college credit with a passing score so as not to incur additional costs for general education requirements to obtain a college degree.
2.
We incorporated the principles of SUCCESS: We kept our displays simple, clear, and easy to understand. We did this by clearly naming the axises (e.g: specifically naming what percentages of students with economic disadvantages each bar in Data Visualization A represents, rather than saying "low," medium," and "high" amounts of ED students), decluttering the data by taking out gridlines, purposefully keeping the color used the same throughout our visualizations to lighten the cognitive load of the viewer.
3.
The audience affected our design choices because we assumed the commissioner would have baseline knowledge and understanding of Massuchusetts public high schools (e.g: graduation requirements). At the same time, we knew he had no time to do a deeper dive into the data to disaggregate the differences between schools, so we did that for him. We extrapolated and separated and categorized the schools into three levels of economic status so he might clearly see the stark differences in schools with economic disadvantages and their subsequent passing rates as well as their lackluster offerings of AP classes.
4.
- Why are there less classes offered in schools with high ED rates?

- Who are the teachers teaching AP classes (disaggregated by race and years-in-service teaching)?
- How are students being funneled into AP classes? Are they encouraged/discouraged by counselors? Do parents know about AP offerings for their students? Are 9th-10th grade teachers recommending students to AP classes?
- Is the school an open AP policy school? (e.g: May anyone take an AP class or does one need a proficient score on the MCAS to be admitted to AP?)
- Are there any materials advertising for AP classes offered in languages other than English?
- Are there smaller learning communities and professional development opportunities for learning about and implementing AP for teachers and counselors?

5.

What was challenging:
- Finding a time to meet to work synchronously
- Creating data visualizations
- Working with Excel
- Finding time to meet with our TF to clarify questions we couldn't find out on our own

Rewarding:
- Working with a willing partner
- Working with a knowledgeable TF
- Gaining confidence to play with Excel
- Discovering what data is important and for what reasons
- Collaborating to seek equity and justice for public high school learners

Notes
- How to group schools because there's so many
  - By city?
  - By county?
  - By size? (e.g: N of students)
  - By "ED rate"?
- % of ED 11th and 12th graders more useful than N because size of schools vary
  - <mark>Low= 0-25%</mark>
  - <mark>Medium= 26-49%</mark>
  - <mark>High= 50%+</mark>
    - Missing data and 0% for % of ED 3-5 scores highest for high schools?
    - Highest number of schools have 0-25% ED G11 and G12, meaning that the number for "all schools" is majority those "low" schools
- Compare % taking AP classes (need to do that to get test)?
- Thinking of using the frequency of AP exams that passed (Is it a small number of AP exams that are being taken?)
- Wish we had data about the teachers (demographics, quality, etc.), supports (e.g: extra study time, etc.)

Is the passing rate of AP exams for economically-disadvantaged students worse when the school has a higher overall population of economically-disadvantaged students?
Is the passing rate worse for schools with a high overall population of economically-disadvantaged students when they have fewer AP class offerings?
Is the passing rate worse for economically-disadvantaged students when there are fewer economically-disadvantaged peers in their classes?
Is the passing rate worse for schools that do not have a "college-going culture"?
Is the passing rate worse when schools with a smaller number of AP test takers?
Is the passing rate worse when schools with fewer BIPOC teachers teaching AP classes?
Is the passing rate worse when counselors do not recommend AP classes to their students? (implicit bias)

Five Whys
1. Why are AP test passing rates lower for ED students?
2.

Suggested steps for structuring your analysis

The intent of this assignment is for you to learn how to make, test, and justify your analytical choices, as well as how to present them effectively. As such, **there are no right answers** for this assignment, only stronger or weaker rationales and stronger or weaker writing and data display choices. But it also means that you have much more freedom in how to design your analysis and report–which can quickly become overwhelming.

Using a systematic process to structure your data analysis may help you feel less like you're drowning in data and develop stronger findings more quickly. Here's what we suggest.

1. Notice that **the outcome measures are already defined**: the number and percentage of tests taken in a high school on which students earn a 3 or higher ("pass"), for all students, ED students, and non-ED students. So, you only need to worry about deciding what school-level factors might contribute to those outcomes and how to measure them, not what outcome to diagnose. You have already begun to analyze the outcome data, in skills assignments 3 and 4.

2. Before looking at the data, use the "worse when / worse for" and Five Whys protocols to **develop a list of reasons** that schools might have low numbers or percentages of students earning a 3 or higher on AP tests, either overall or among their economically disadvantaged students.

   It may be useful to think about the process that needs to unfold for students to succeed on the AP: high student achievement levels, access to AP classes, enrollment in AP classes, and actually taking the AP test. To what degree are the conditions present in each school to support students' success on the AP? How does the situation differ for students with and without economic disadvantages?

3. For each of the reasons, **identify specific metrics** that measure the concept(s) you are interested in and that you can calculate using the available data. You will likely identify some measures you would like to include but that are not available in the data; if so, note them in your assignment reflection.

4. **Explore the data.** Now that you know which variables you are most interested in analyzing, follow the same steps as assignment 3 to learn more about the data: Look at the data for those variables visually, think about the implications of any data quirks, explore the data with graphs, and look at the mean, median, standard deviation, and key percentiles to get a sense of the typical values and their range.

5. **Analyze the relevant data.** In this step, you will run some analyses to narrow down which findings and comparisons you want to highlight. You do not need to conduct any

multivariate analyses or tests for statistical significance; simple descriptive statistics are sufficient. Consider sketching out some blank tables to think through which comparisons will be most useful.

You will likely run many more analyses than what ends up in your final memo. You are practicing the skill of running enough different options to make an informed choice about what to include and exclude—and the skill of knowing when to stop.

6. **Draft your findings and data displays**. Write some findings, organize them in a logical order, decide which would most benefit from data visualization, and draft some data displays. This can serve as an outline for your memo.

   As you're doing this step, remember that these data are at the school level, not the student level, so we have to be careful about how we describe our findings. See skills assignment 3 for details.

7. **Draft your narrative.** Once you've nailed down the main findings and data displays you want to feature, you can begin writing the text to accompany them. You may find you need to run additional analyses at this point to fill in holes in your narrative. As you write, link each finding back to the initial question. **How does each finding address the question of why high schools vary in the number and percentage of AP tests taken by their students that earn a score of 3 or higher, especially for students from economically disadvantaged backgrounds?**

8. **Put the bottom line up front.** Start your memo with your main findings. Then fill in any background, analysis, discussion, and other details. Eric Taylor's guide to writing policy memos and other materials from Module 3 of the course may be helpful.

9. **Leave yourself plenty of time for writing, data visualization, and revision.** Keep in mind this quote, attributed to everyone from Cicero to Mark Twain: "If I had more time, I would have written a shorter letter." 800 words is much shorter than you are likely to be accustomed to for this type of writing; it's about 1.5 pages of single-spaced, 12 point text. But, it's the typical length of an op-ed in a newspaper, so it's plenty of room to summarize your key findings if you are judicious about what you include. Similarly, refining a data visualization can often take several rounds of editing as you declutter and try different strategies for focusing attention where you want it. **As a rough guideline, spend about half your time on analysis and half your time on writing, data visualization, and revision**.

Feedback

In the professional world, virtually no work product is final on the first draft. Every article and report I have ever written went through multiple rounds of revision, and as a manager I expected that I would provide feedback on my staff's work before publishing it or sharing with stakeholders. My expectation is that your work products will be the same.

The teaching team will provide detailed feedback on this assignment to help you see what you have done well and where you could improve. We will also provide an assessment of how much revision your work requires to meet expectations, as follows:

- **Exceeds expectations**: A product that exceeds expectations is ready to share with stakeholders, perhaps with a few minor revisions. It exhibits most or all of the relevant elements of strong content and style (see list below).

- **Meets expectations**: A product in this category meets the same expectations I had for my staff for a first draft: solid work that needs some polishing before it's ready to publish or share. It exhibits many of the relevant elements of strong content and style.

- **Developing**: A developing product requires revision to meet expectations.

- **Not assessable**: A product that is not assessable wasn't submitted at all, or it was missing so many required elements that it wasn't possible to provide feedback.

We will ask you to revise and resubmit your assignment if we rate it as developing or not assessable, so that you have an opportunity to respond to the feedback and bring your work up to expectations. We'll then reassess, provide more feedback, and update your rating. Your rating might stay as developing or might improve. Only one revision is required, but you may continue to revise your work until you have met expectations if you wish.

We will only re-evaluate work originally rated as developing or not assessable, so that we can focus the teaching team's efforts towards students who have not yet met expectations.

Elements of strong content	Elements of strong style
- Demonstrates competency with course material - Advances a well-supported, well-organized, credible, and concise argument or narrative - Incorporates compelling writing and visuals to support the argument - Uses data with technical accuracy; for example, avoids making causal claims about findings from non-causal studies, and avoids conflating statistical significance with practical importance	- Uses a visual and written style appropriate for the type of deliverable and the audience - Uses active voice - Avoids technical jargon - Is free of errors in spelling, usage, and grammar and makes consistent capitalization and punctuation choices - Abides by length and content requirements - Includes a list of works cited at the end, if relevant. This does not count towards the length limit, and I have no preference on which citation style you use.

Kelly Coons
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