

Streamlined Prerequisite Pathways

Using Degree Map Analysis to Identify Curricular Bottlenecks

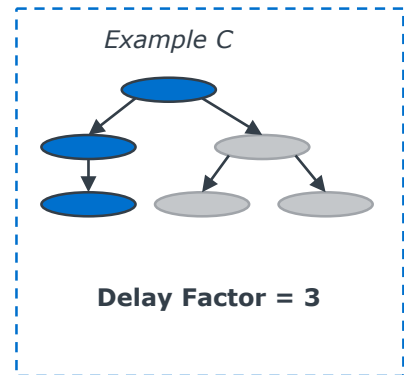
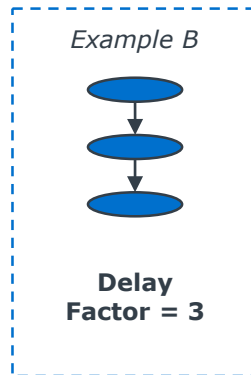
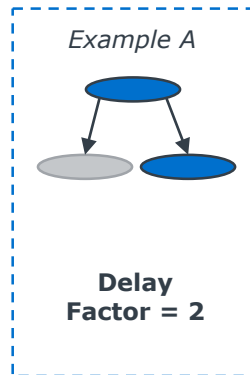
Beyond increasing the number of instructors or increasing the number of students per course, there is a third way to increase capacity: changing the patterns of demand at the curricular level. Curricular requirements can create bottlenecks when one course is required for a large number of majors. Conversely, restructuring requirements to avoid these curricular-level bottlenecks reduces capacity constraints. In order to help faculty identify critical areas for curricular reform, an analysis from researchers at the **University of New Mexico** visualizes departmental curricula as tree diagrams with each course as a node.



Delay Factor

Definition: The length (in connections) of the longest path on which a given course falls

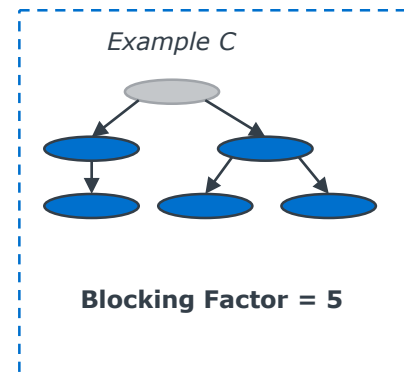
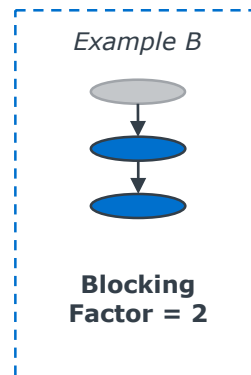
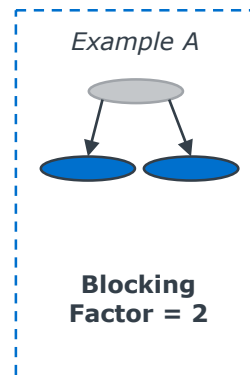
Calculation: Sum the connections between courses which are linked to a given course (in blue, below); this sum is the **Delay Factor** of that course



Blocking Factor

Definition: The number of other courses to which a given course is a pre-requisite

Calculation: Sum all of the courses which can only be taken after completing a course (in blue, below); this sum is the **Blocking Factor** of that course



<i>Blocking Factor</i>	+	<i>Delay Factor</i>	=	Course Importance
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There are two critical elements which are used in the University of New Mexico analysis, shown above: **Blocking Factor**, which denotes the number of courses to which a given course is a pre-requisite, and **Delay Factor**, which denotes the longest path on which a given course falls. The sum of a course's Blocking Factor and Delay Factor is **Course Importance**, a measure of how crucial that course is in determining a student's progress through the curriculum. Courses that enable many other courses will have a higher Course Importance score, as will those that are on very long consecutive prerequisite pathways.

Source: Abdallah, et al., "Curricular Efficiency: what Role Does It Play in Student Success?" 2014; Abdallah, Heileman, Kozlick, and Slim, "The Complexity of University Curricula According to Course Cruciality," 2014; EAB interviews and analysis.

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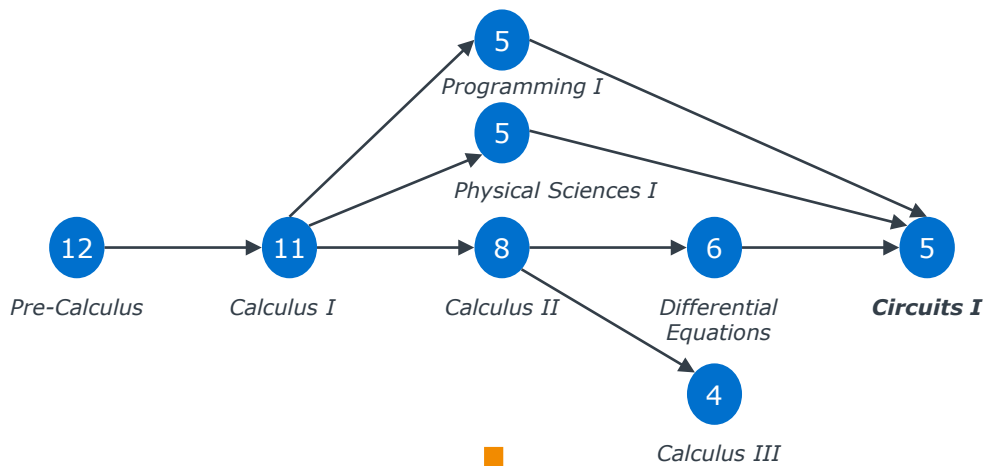
Leveraging Curricular Bottleneck Analysis to Reduce Complexity

The examples below show how the curricular complexity analysis can help academic units identify opportunities for curricular streamlining. A degree pathway's curricular complexity score is the sum of all courses' importance scores.

The example on the top shows the complexity of the pathway students had to complete in order to enroll in Circuits I in an electrical engineering program. Students had to complete programming, physics, and advanced mathematics in order to progress to introductory-level electrical engineering work. The curriculum was confusing to students and created course bottlenecks, especially in the math sequence.

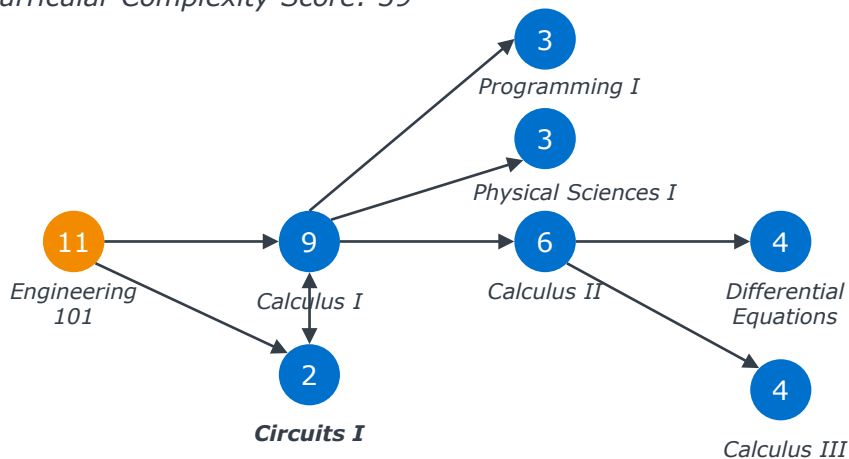
Before Streamlining

Curricular Complexity Score: 56



After Streamlining

Curricular Complexity Score: 39



The revised curriculum after streamlining appears above. A new course, Engineering 101, was added. The course served as a prerequisite to Circuits I, focusing on engineering-specific applications of the material. The changes significantly reduced the complexity of the curriculum while improving student learning outcomes (by providing more foundational engineering knowledge). Students could also progress much more quickly to electrical engineering-specific coursework that relates to their interests and career goals.

Source: Heileman GL, Abdallah CT, "Curricular Analytics," University of New Mexico Academic Affairs; EAB interviews and analysis.