Higher education is under greater scrutiny these days, as concerns are raised about costs, accountability, and value. A particular concern centers around baccalaureate graduation rates: it is perceived that too many students take too long to graduate or drop out. As institution-wide graduation rates are scrutinized, it is being recognized that students graduation rates may vary significantly across majors, and that advising by the major department is a major determinant of student retention and graduation rates. Hence there is a growing interest in tracking graduation rates by major discipline.

However, it turns out that disaggregating graduation rates by discipline is not a straightforward process. While defining graduation rates institution-wide is relatively simple, there are multiple ways to define graduation rates by major. This paper reviews the definition of institutional graduation rates, analyzes the multiple pathways involved in major-based graduation rates, and proposes a methodology for defining and measuring major-based graduation rates.

**Institutional Graduation Rates**

Exhibit 1 below illustrates the flow of students through an institution (say SSU). First-time freshmen (FTF) count at year 0 (the amount A) go through a process that has them either graduate from SSU (amount B), or transfer to another CSU and graduate there (amount C) or leave the CSU altogether (either graduating from a non-CSU institution or never graduating) (amount D).
These three outcomes allows to define three institutional graduation rates unambiguously for either a four-year or a six-year period:

\[
\begin{align*}
\text{Intra-SSU graduation rate for SSU } g_1 &= \frac{B}{A}; \\
\text{Cross-CSU graduation rate for SSU } g_2 &= \frac{C}{A}; \\
\text{Total CSU graduation rate for SSU } g_3 &= \frac{(B+C)}{A}.
\end{align*}
\]

**Graduation Rates by Major**

In order to define graduation rates by major, we need to analyze the multiple paths followed by baccalaureate students. We also need to specify which major we are tracking: the originally declared major, or the major in which the student graduates. Exhibit 2 below tracks the multiple paths by originating major:

Exhibit 2
Graduation Paths Disaggregated by Original Major

- (E) FTF initially selecting Major X
- (F) FTF graduating in original major X
- (G) FTF graduating in other major at SSU
- (H) FTF leaving SSU

Based on the paths above, we can define the following graduation rates for major X:

\[
\begin{align*}
\text{Graduation rate of originally-declared FTFs} & \quad g_{s1} = \frac{F}{E} \\
\text{Graduation rate of changed-major FTFs} & \quad g_{s2} = \frac{G}{E} \\
\text{Overall graduation rate of original department} & \quad g_{s3} = \frac{(F+G)}{E}
\end{align*}
\]

The advantage of these multiple definitions is that they allow us to track the contribution to graduation rates by the initial home advising department regardless of whether the student opted to change majors, while at the same time allowing us to measure major retention rates.

Exhibit 3 below tracks the multiple paths for graduation out of a particular department.
Graduation Paths Disaggregated by Graduating Major

Based on these paths, we can define the following graduation rates:

- Graduation rate out of department X by original FTF majors:
  \[ g_{x1} = \frac{F}{E} \]

- Graduation rate out of department X by changed majors:
  \[ g_{x4} = \frac{L}{K} \]

- Graduation rate out of department X by transfers:
  \[ g_{x5} = \frac{N}{M} \]

- Overall graduation rate out of department X:
  \[ g_{x6} = \frac{F + L + N}{E + K + M} \]

The advantage of these measures is that they capture the contributions to institutional graduation rates by graduating departments, regardless of whether the department retained original FTF majors, graduated changed FTF majors, or graduated transfer students.

Systematic use of these measures across the institution can allow detailed and revealing insight into the multiple patterns of retention and graduation across majors. Collectively, they capture fully the extent to which entering and transfer students succeed in graduating, something which the single measure \( g_{x1} \) cannot do.
**APPENDIX**

*Receiving Department Graduation Rate of Changed Majors*

The graduation rate $g_{x4} = \frac{L}{K}$ outlined above is somewhat more complicated when looked at in detail. The complication lies in defining precisely the denominator $K$. In order to have $K$ well-defined, we need to identify a unique cohort year. For the case of a four-year graduation rate, the process flow would be as follows:

\[
\text{Year 1 FTF Undeclared or Other Major at Entrance} \\
\text{Year 1 FTF Selecting or Changing to Major X in Year 1 (K₁)} \\
\text{Year 1 FTF Selecting or Changing to Major X in Year 2 (K₂)} \\
\text{Year 1 FTF Selecting or Changing to Major X in Year 3 (K₃)} \\
\text{Year 1 FTF graduating in major X who did not declare X at entrance (L)}
\]

In this analysis, $K = K₁ + K₂ + K₃$, where each term represents the number of students in years 1, 2, and 3 that were First-Time Freshmen in year 1, and who were either undeclared at entrance and selecting X as their first major, or who came in declaring another major and are changing to major X.