Perm Augmentation

Whitepaper

Table of Contents

Executive Summary

UCSB currently assigns a six digit identifier (referred to as a perm) to all undergraduate and graduate applicants, as well as Summer Sessions students. The current six digit field allows for a total of approximately 1,000,000 unique Perm numbers. At our current rate of usage, we expect that will run out of available Perm numbers as early as 2024, and as late as 2030. Therefore, we need to identify a resolution to this issue to ensure we can continue assigning unique student perms.

This document outlines the proposed approach to mitigate this issue, which is to move from a strictly numeric six digit Perm to an alphanumeric six character perm (e.g. a six character string of letters and numbers). This would increase the total number of possible unique Perms from 1,000,000 to over 2,000,000,000, which will resolve this issue for the lifetime of the existing Student Information System (SIS).

Project Timeline

- Discovery, Analysis, and Planning: 6/1/2019 - 12/31/2020
- Execution and Updates: 1/1/2021 - 5/31/2021
- Integration Testing and QA: 6/1/2021 - 9/30/2021
- Go-Live: 10/31/2021
- Project Closure: 11/1/2021 - 11/30/2021

Introduction

This document provides a deep dive into the issue of running out of available perms; a detailed background of the challenges; the solutions that have been considered; the technical details of the proposed changes; and the identified impacts of those proposed changes.

What is a Perm?

A Perm is a six digit identifier at UC Santa Barbara that is assigned to applicants and students. Perms are sometimes written with seven digits, though the seventh digit is a 'checksum," meaning it is a calculation using the first six digits of the perm to ensure the perm is valid.

IMPORTANT NOTE ABOUT PERM IDENTIFIERS
It is important to note that while the perm is often written and discussed as a seven digit value, in the SIS, the identifier itself is only six digits long.

Definition of Terms

Term	Definition
Access Card	The Access Card is the UCSB student id card that students typically obtain during their orientation session. This card can be loaded with money, and used similar to a debit card on campus, and in a set of specific locations in Isla Vista. The card has a student's picture and perm on it, and also includes a barcode that is used for book loans at the UC Santa Barbara library. Staff and faculty can also obtain ID cards, but these are out of scope of this effort.
Checksum	A digit representing the derived value (using the Luhn Algorithm) of the six digits of a perm, against which later comparisons can be made to detect errors in the perm. The checksum is NOT a part of the perm identifier itself in the SIS. Wikipedia
Luhn Algorithm	The Luhn Algorithm is the algorithm used to verify a six digit perm. It uses the six digits of the perm to calculate the checksum, which is compared against the provided checksum (if one is provided) to verify the perm was entered correctly. Wikipedia
Perm	A Perm is the 6-digit identifier at UC Santa Barbara. Perms are sometimes written with seven digits, though the seventh digit is a 'checksum," meaning it is a calculation using the 6-digits of the perm to ensure the perm is valid. In the SIS, the perm is a 6-digit identifier; the checksum is not stored or considered to be part of the perm itself.
SIR	Statement of Intent to Register. This is an incoming student's official acceptance of the Admission letter. It indicates that the student confirmed their intent to attend UC Santa Barbara.
SIS	Student Information System. The combination of applications, services, and data stores that comprise the centralized system used for managing student information (including, but not limited to, admissions, financial aid, student, registrar, and other pertinent institutional information).

Background

UC Santa Barbara assigns perms to all applicants, students, and non-UC Santa Barbara students attending UC Santa Barbara courses. The number of applicants each year has gone

up, and because the perm is a 6-digit value, we are nearing the point where we will run out of available perms (*see Appendix 2: Perm Usage Analysis for the most recent analysis from 2018).* To address this, we are proposing moving to an alphanumeric perm, which would permanently solve the issue of running out of available perm identifiers.

Perm Usage, Assignment, and Recycling

Usage

A perm is an identifier for applicant and student records at UC Santa Barbara. This value is used when working with student and applicant records. Perms are also included on the magnetic stripe of student ID cards (Access Cards) for UC Santa Barbara students.

Assignment

Perms are assigned in one of three ways:

1. Undergraduate Applicants (Approx. 110,000/year)
2. Graduate Applicants (Approx. 10,000/year)
3. Non-UC Santa Barbara Students UC Santa Barbara courses (Approx. 1,000/year)
    a. *Note: This includes situations such as Summer Sessions, Cross Campus Enrollment, etc.*

By far, the largest assigner of perm numbers is the undergraduate application process. All undergraduate applicants to UC Santa Barbara -- approximately 110,000/year -- are assigned a perm identifier as part of the application process. In general, perms assigned to applicants who are not accepted to -- or otherwise do not matriculate to -- UC Santa Barbara are recycled on a periodic basis *(see 'Recycling' section below)*. However, there are risks associated with this recycling effort, and ideally perms would not be recycled at all. The recycling process was implemented in the mid-2000s to address the initial perm shortage, and was originally done based on a four year retention period. This retention period is now down to two years, because we have so few available perms.

Recycling

Perms that are assigned to applicants who do not matriculate to the university have their perms retained for two years, after which they are made available to assign to future applicants.

As we have started running out of available perms, the perm retention period has dropped from four years to two years, and our recycling frequency has gone from a once every two years process to an annual process. This has introduced additional complexities related to disentangling an assigned perm from the applicant's information in preparation for reuse.

Additionally, we will soon reach a point where even recycling will not provide enough available perms for the next year's applicants. *(See Appendix 2 for details on the perm recycling history.)*

Going to an alphanumeric perm will allow us to forgo the recycling of perms entirely.

Technical Details of a Perm

While perms are effectively unique for students while they attend the University, they are not completely unique in a strict sense due to Perm "recycling". Specifically, the same Perm assigned to a current student's record might also be assigned to historical applicant records of different people from prior admission quarters. Most Perms have been re-assigned to three or more people.

Additionally, while perms currently consist only of digits, they are *not* a numeric value. For example, valid perms can begin with a 0 (for example, there is a student who originally attended UC Santa Barbara in the 1980s, and has recently returned for a second baccalaureate; they have a perm that begins with 0). Therefore, all perms should be stored as strings of characters already, which is why we believe the move to an alphanumeric perm is the least disruptive of the considered options.

Finally, it is important to reiterate that while perms are often written as seven characters, they are actually only six characters long. The seventh character -- the 'check-sum' value -- is a value that is derived from a calculation using the first six characters. This check-sum value has historically been used to guard against the incorrect keying of perms (i.e. typos), in particular in the mainframe period of the SIS.

Approaches Considered

Approach	**Pros**	**Cons**
Alphanumeric Perm (Proposed Approach)	• We believe this to be the most cost effective solution (for all the reasons listed below). • Requires fewer changes to the very complex, brittle Admissions, Registrar, and Financial Aid systems • Provides more than enough available perms for the future (just having alphanumeric values available in the first field will give us 2.6 million new available	• Some systems that utilize perm will require updates to data storage to ensure they can work with an alphanumeric value. • All systems using the luhn algorithm to verify perm checksums will need to be updated to work with alphanumeric values. • Any systems performing a numeric validation for perms

	perms) • Will not interfere with currently assigned six digit perms, allowing all existing perms to continue working without requiring any changes. • An initial analysis indicates that the vast majority of campus systems are able to handle an alphanumeric perm with relatively few changes. • Keeping it to six characters makes it easier for students and administrative staff to remember and communicate this value, especially for individuals who are working with large volumes of perms on a regular basis.	will need to be updated • Requires analysis -- and potentially changes -- to all systems that utilize Perm • There may be concerns or issues related to case-sensitivity
Assign Perms Only to Students who have completed Statement of Intent to Register (SIR) at UC Santa Barbara	• Does not require any downstream changes of systems or services • Largely resolves the issue of perm recycling	• The required Admissions, Grad. Div., Registrar, and Financial Aid system updates are substantially more complicated than changes to accommodate an alphanumeric value. In Admissions alone, this would require the replacement of over one million (1,000,000) lines of code. • Pushes the problem down the road, but does not actually solve the underlying problem of running out of available perms. • May not avail enough perms in the case that enrollment numbers increase dramatically (e.g. through expansion of online education). • Assumes that the SIS is replaced in the near future, and that replacement of the SIS will solve this problem. • We anticipate we would run out of available perms in the

		next 10 years (approximately). • May cause confusion for students, who would be getting three different assigned numbers: a UC applicant ID, a UC Santa Barbara applicant ID, and upon SIR, a UC Santa Barbara Perm • Would require numerous academic departments to make updates to their system to be able to accommodate the pre-perm applicant ID, and update that to the perm value upon perm assignment.
Extend Perm length	• Extending perm length (by two or more digits) will provide us with enough perms to solve the problem for the foreseeable future.	• Will require major changes to all systems and services that use perm. • *Note: This would likely be even more complex than the changes required for the updates to the Employee ID related to the UC Path conversion.* • Will require substantial changes across the entire Student Information System (SIS) • Any integrations or interfaces built on the assumption of the existing six digit perm length will need to be updated • Could cause conflict or confusion with other identifiers, including the Employee ID. • Longer perms are more likely to be forgotten, and are more error prone • Will require more staff across the campus to work on this effort, reducing ability to respond to other needs and mandates

Proposed Approach

Of the three approaches considered, the alphanumeric option has been selected because it allows for a large pool of new perm numbers while minimizing the scope of changes required in the complex Student Information System (SIS). The new alphanumeric perm will consist of six alphanumeric characters, and when used, a seventh check-sum digit for validation. The addition of uppercase alpha characters could supply a maximum of over 2.1 billion new perms, although considerations for complexity, ambiguous characters, and existing perm usage will reduce the size of the pool.

Access Card Changes

The details of changes to the Access Card (the UC Santa Barbara student id card) are still under discussion, and will be available in the *Perm Augmentation Access Card Whitepaper.*

Challenges related to the campus Access Card include an inability to support alphanumeric values on the magnetic stripe, the current barcode font not supporting alphanumeric values, and an incompatibility with campus point of sales systems.

Sample Alphanumeric Perms

The following are examples of alphanumeric perms that would be valid based on the proposed approach above:

- 999999-6: Existing numeric perms
- AAA999-2: Mixed alphanumeric characters
- AAAAAA-8: Unlikely to be assigned, but all alpha character perms are valid (with trailing check digit)

Checksum Calculation

For calculating the optional seventh checksum digit, we will use the following variation of the Luhn algorithm:

- https://wiki.openmrs.org/display/docs/Check+Digit+Algorithm

Approach Considerations/Questions to Answer

Decision Point	Decision and Rationale

Will we use the full A-Z set, or will we exclude Ambiguous Characters (e.g. BDGILOQSXZ)?	Decision: We will initially exclude the following characters from alphanumeric perms: BDGILOQSXZ. However, based on circumstance, we may begin to use these characters in the future, and thus, we do not endorse validation that takes into account these excluded characters. Rationale: Perms are regularly relayed through written mean, including paper forms, emails, hand-written notes. Removing any misinterpretation relating to character/number confusion (e.g. O vs. zero) will help to maintain data integrity and reduce possible confusion. Additionally, X is used as the initial character for UC Santa Barbara Extension student identifiers, and thus will not be initially included in alphanumeric perms. Assuming the listed characters are removed and only 1 alpha character is added, this will provide 1.6 million new perms ($16 * 10^5$).
Should we avoid using 'X' as the first character in the Perm, so as not to cause confusion with UCSB Extension students, whose ID begins with an X?	Decision: Yes. Initially, we will avoid using X in alphanumeric perms. Rationale: Avoiding the use of X in the first character will ensure no conflict with Extension student logic in the SIS and the reduction in available perms is insignificant.
Should we put characters in a smaller set of fields (e.g. only the first field)?	Decision: Limiting characters to the first field will be the initial approach, and will be expanded as needed. Rationale: Limiting characters to the first field has the following benefits: easier perm assignment, no concerns with filtering profanity, easier for students, staff, and faculty to remember. Although, validation should be able to accept all forms of alphanumeric (A-Z, 0-9) perm to allow for expansion.
Will alphanumeric perms be treated as case-sensitive?	Decision: No, but alphanumeric perms will be stored in the SIS with uppercase characters only. A99999 = a99999. Rationale: The only benefit to using case-sensitive perm numbers is increased pool size, which is not necessary. The downside is increased complexity for users. Users should be able to enter and search for perms using upper- and lower-case characters.

	The perm numbers will be stored in the SIS as uppercase to ensure consistency when passing data to downstream systems.
What will be the approach to assigning alphanumeric perms?	There are several options being considered, and as such, we do not want to commit to a specific approach at this time. The most likely scenario is to begin by assigning perms with a single alphanumeric character in the first field, and expanding usage from there as needed, however, this is not guaranteed, and we reserve the right to take other approaches based on emerging information and circumstances.

Testing Approach

We will put into place test alphanumeric perms for a number of applicants and students in the TEST environment for the purposes of testing alphanumeric perm changes. No alphanumeric perms will be placed into the Production environment for test purposes, due to the myriad challenges such an approach would introduce.

Test perms and information will be available via Apigee Test APIs (which will be made available in the test environment: test.api.ucsb.edu), and via a test file. Additionally, we will work with individual stakeholders to ensure they have the requisite information to test the required changes to their system(s). Please reach out to us for this purpose if you anticipate having such a need.

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Appendix 1: Impact of Proposed Approach

Initial Analysis

679 Applications were initially identified by members or campus or by having existed in a previous inventory of software applications used on campus. Through various queries to different departments on campus, responses were received for all applications.

Of the 679 applications, 497 were reported to not be using the Student Perm Number. 181 applications were reported to either be using the Student Perm or "Maybe" using the Student Perm Number. Of the 181 applications that were using the Student Perm Number, 158 applications were reported as being able to support an Alphanumeric Perm. *As a result, 23 applications reported a "No" or "Maybe" that the application could not support an Alphanumeric Perm Identifier. Of those 23 applications, 10 were "NO" and 13 were "Maybe."*

Those 24 applications can be viewed using this filter link:

- https://docs.google.com/spreadsheets/d/1rJvN6Rxd0eQ7aglnC-R-CTHNkvgNEDTOhqw9_MCoGnk/edit#gid=1359322762&fvid=884949646

There are 16 of the above 24 applications that could have an impact on the Campus as a whole:

- https://docs.google.com/spreadsheets/d/1rJvN6Rxd0eQ7aglnC-R-CTHNkvgNEDTOhqw9_MCoGnk/edit#gid=1359322762&fvid=1845200980

Current project efforts revolve around determining issues and solutions for the UCSB Access Card and what changes may be needed so that the Access Card works properly for the applications that use it. There are interdependencies with the Access Card and Kronos Time Clocks which use the mag-strip and the Library which uses the Barcode on the card. As well as possibly the Innosoft Fusion Point of Sale application used by the Rec Center.

ACCESS CARD (Barcode and Magstrip)

Barcode: Need to change from Codabar format to code 128 format. Need to adjust font formatting of Barcode for printing on the physical card.
Magstrip: Can only support one number on the 3 different rows as there is no way to define differences in the numbers. May need to pursue providing student employees who use Kronos with a seperate card, that has their Employee Number instead of Perm Number, for Kronos Timeclock swipes.

KRONOS (9 apps) → Access Card Magstrip

The Kronos application cannot accept Alphanumeric characters in the data field that holds the identification number for clocking in via a timeclock. It will be necessary to look at solutions for how this can be addressed. One solution may be to provide student employees who use a time clock with an additional card that is programmed with their Employee ID number instead of their Perm Number. This would allow them to clock in at a time clock. Alternatively, the student may be able to punch in their employee ID at the time clock.

LIBRARY → Access Card Library Barcode / Barcode Scanners

The library is able to program their library catalog system to use Alphanumeric characters. The library uses the barcode on the Access Card to checkout books at their Service Desk using barcode scanners as well as via automated checkout machines near exits. Need to ensure that the scanners themselves can scan an Alphanumeric barcode as well as a Numeric Barcode. *The library also may not want students to have two cards with the barcode on it - if students have multiple cards for Timeclock usage (not sure).*

REC CEN INNOSOFT FUSION POS → Access Card Barcode and Magstrip

The INNOSOFT application is used to manage the Rec Centers processes for membership swiping, setup and sale of all rec cen classes, equipment check in/out; locker sales and management, website sales and the point of sale system. Fusion uses the Access card to swipe in for memberships for students and faculty/staff. Fusion is configured to use either the mag stripe or bar code on the Access card for access to the Recreation center. Appropriate testing will need to be conducted to ensure the application can scan or swipe an Alphanumeric Perm. Per Pam Layton, the application itself can store alphanumeric characters.

Agilysys POS

Need to verify

MBS POS

Need to verify

Communications Services Web Residential Service Requests

To perform testing, they are requesting a Perm Number that exists in Housing.

MWI Configurator (PBX) (Email Notification Services)

They will perform testing using the same Perm Numbers as those provided for the "Communications Services Web Residential Service Requests."

The remaining 8 applications from the list of 24, consist of departmental applications that will need to be adjusted, retrofitted, or retired. Departments should take action to adjust these applications if necessary.

See the filtered link for those applications:

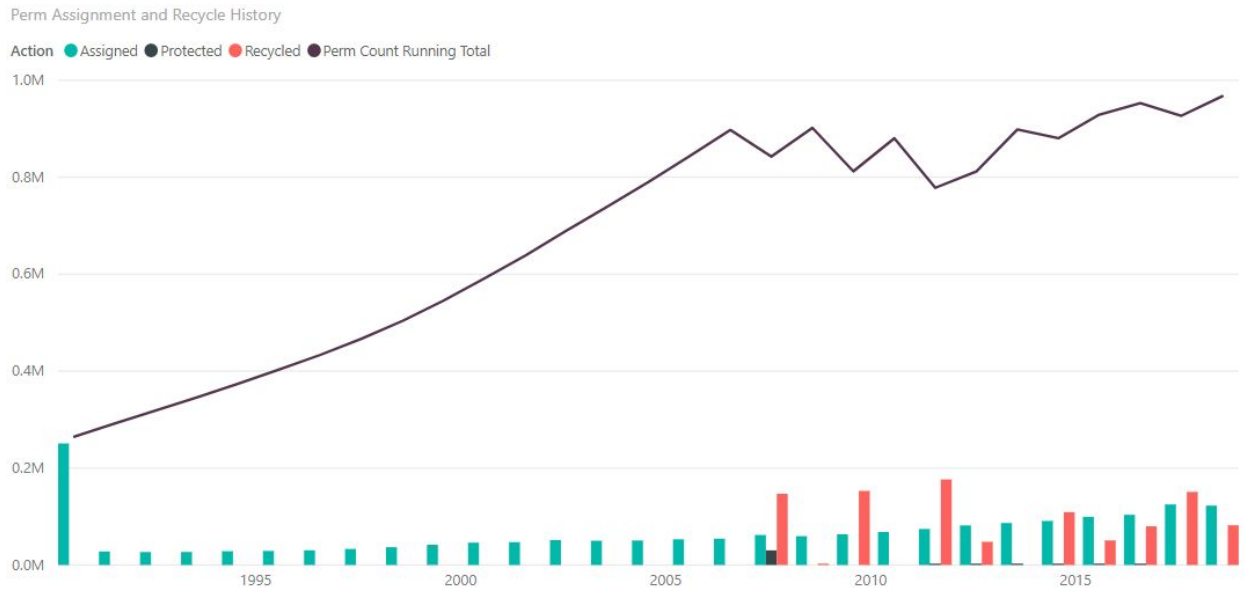
- https://docs.google.com/spreadsheets/d/1rJvN6Rxd0eQ7aglnC-R-CTHNkvgNEDTOhqw9_MCoGnk/edit#gid=1359322762&fvid=1842101049

Appendix 2: Perm Usage Analysis

The following are excerpts from a 2018 Perm Usage Analysis performed by the Admissions Information Systems (ADIS) manager, Jarrod. Sprague.

Predicted Perm Usage

Perm Assignment and Recycle History

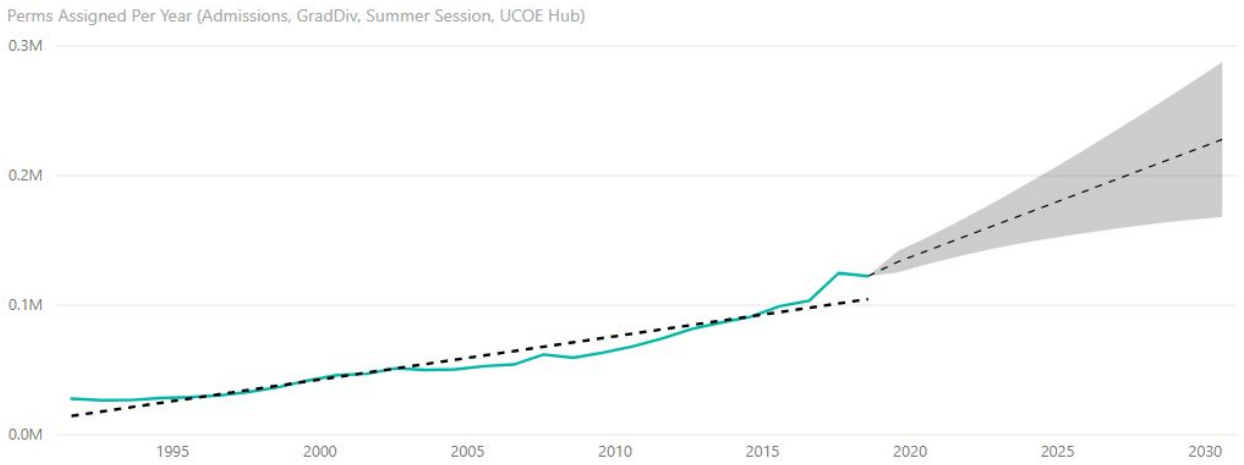


Notes:

- The graphs above define a Year as being August 1 to July 31 to capture an Admissions cycle that starts with Perms being recycled, then Perms being assigned to incoming applicants by GradDiv and Undergraduate Admissions. For example, the 2017 year is August 1, 2017 to July 31, 2018.
- 13,844 Perms not accounted for in Perm assignment history/log, but are not available for reassignment.
- 30,000 Perms are "protected" from assignment for Accounting dept. purposes (out of 30,248 total protected Perms).
- 155,319 Perms available for assignment as of 9/15/2018.
- 32,759 Perms available for assignment as of 2/1/2019.
- Last Perm Recycle was 8/29/2018, and recycled 81,994 Perms up to 10/31/2015 (F14 to S15)

Forecast of Future Perms Assigned Per Year

Forecast for perms assigned Admissions, GradDiv, Summer Session, UCOE Hub.



Forecast of Perms Permanently Assigned to Students Per Year

Forecast of Perms Permanently Assigned to Students Each Year that cannot be recycled.