UNCW Office of Institutional Research: Masters of Data Science Practicum Campus Space Utilization

Executive Summary and User Guide

Version 1.0

12/06/2018

Table of Contents

Executive Summary

User Guide

EXECUTIVE SUMMARY

University CSU: Web-Based Space Utilization Tool for Investigating Trends in and Providing Real-Time Analysis Room Use at the University of North Carolina Wilmington

Michelle Page, Hilary Melroy, Brittany Palmer, and Greg Terlecky

December 6, 2018

Abstract

Understanding utilization of existing space resources across the University of North Carolina Wilmingtons (UNCW) campus has applications in long-term, short-term and real-time emergency needs. This information can be used to support plans for upgrades and expansions of the physical plant, as well as assist in the scheduling of classes under normal circumstances and in the event of needing to reassign classroom space. Historical data can be used to understand trends in space usage, provided it can be collected and organized uniformly. Additionally, fundamental characteristics that define the potential use of the elements must be included to understand trends in the use of specialized spaces within the physical plant. With such information in hand, an interactive, administration-facing, web-based dashboard for assessing space utilization at UNCW has been developed for the visualization of room usage across the university.

1 Introduction

Managing teaching space at the university level efficiently is a complex often a difficult task. Many factors such as room capacity, specialization of the room (e.g. computer lab versus general instruction space), and departmental classroom ownership play into how a room is used. Historically, room bookings have been done by individual department administrations, though with sparse communication between departments and a subsequent first-come-first-serve system once administration takes its pick, this approach leaves some spaces under-utilized while creating certain pressure points of over-utilized rooms. Furthermore, teaching space becomes increasingly valuable as student populations grow and as more programs are offered. A thorough understanding of how well teaching space is being utilized across campus can be a useful tool not only during the booking process but for future planning as well.

In addition to booking rooms for academic courses and future institutional planning, understanding utilization of the existing space resources across a university campus has applications in real time emergency planning as well. For example, the destruction brought to UNCW by Hurricane Florence in the fall of 2018 required rearrangement of classes to different teaching spaces due to damage sustained to Dobo Hall. This can be used to support plans for upgrades and expansions of the physical plant of the institution. Historical data can help to understand trends in space usage, provided it can be collected and organized uniformly. Additionally, fundamental characteristics that define the potential use of the elements must be included to understand trends in the use of specialized spaces within the physical plant. With such information in hand, an interactive, web-based dashboard for assessing campus space utilization (*CSU*) called University *CSU* has been developed as a tool for visualizing and optimizing room use across a university.

A tool that displays current and historical room booking information in detail is useful for anyone who has the responsibility of booking rooms, or wants to understand trends in the usage patterns of rooms more generally over time. As previously mentioned, this would also greatly aid in navigating anomalous situations that require re-assigning classes to different rooms in the event of sudden restriction to usable classroom space. To this end, an online, administration-facing dashboard has been built which allows users to visualize room usage trends across all academic buildings on the University of North Carolina Wilmingtons campus Here we discuss the needs that this tool addresses, along with a discussion of the content of the dashboard, and finally an addendum of a comprehensive users guide which details how to use and maintain the tool.

2 Problem

Studying the trends in historical room booking practices across a university campus can potentially shed light on how to better utilize the resources already available to the university, as well as inform future planning of course offerings and planned construction. Additionally, there are prescribed standards from the General Administration (GA) which give guidance for target seat-fill ratios for teaching space at all of the UNC system universities. Data from several university sources were collected, transformed and examined in order to determine adherence to the GA standards, and it was found that several rooms experience chronic overuse, while some rooms experience chronic under use. The objective of this work is to create a tool that can help stakeholders gain insight into historical trends and provide guidance for planning in both the short and long term.

3 Data

Scheduling and room data was obtained from the UNC Student Data Mart for all campus buildings from fall 2015 to fall 2018. For analysis and consistency purposes, all summer sessions were excluded. The information contained in the resulting *CSV* files includes multiple characteristics for each course offered course name, course type, primary course instructor, the building and room in which it is held, the capacity of the room, the enrollment for the class, etc. Since online classes do not meet in a physical location and at a designated time, these courses are excluded from the analysis. Information relating to room capacities, actual enrollment in courses, room type (i.e. departmental lab, computer lab, traditional classroom, etc.) and room ownership (which department does the room belong to) are most relevant to the analysis.

The excel schedule data was read into *SAS 9.4* using the *XLSX engine* to import all building excel sheets. To streamline cleaning and merging all of the building's data, a macro is implemented so that the current process depends only on the excel sheet name, along with the desired output dataset name. Cleaning the data consisted of accounting for overlapping times and part term courses through retaining and looping through certain variables. Also, multiple courses (i.e. STT 411/STT 511) in a room at the same time and part term courses were combined to obtain an accurate seat capacity percent. ***Figure 1*** below shows a screenshot of the raw data before cleaning, while ***Figure 2*** shows the same course and section once the cleaning and validation are complete.

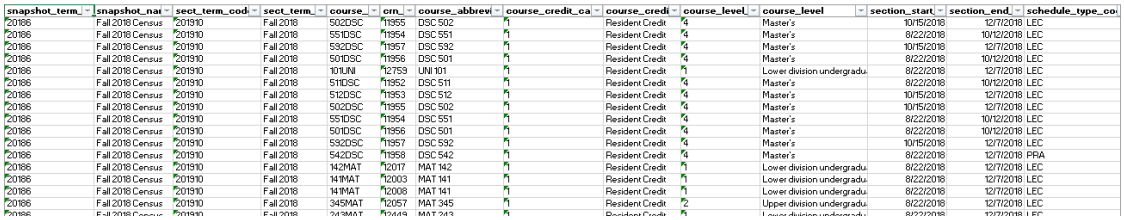
To provide a visual basis for each building in the dashboard, floor plans of academic buildings were obtained internally through the university and manipulated through *SAS 9.4* using *PROC MAPIMPORT* and *PROC SGPLOT*. In order to make the floor plans usable for creation of polygon plots, shapefiles were read in using *PROC MAPIMPORT*. Beyond the x and y positioning variables, important variables available in the plan files that were preserved include a room number and the object identifier (which gave a unique identifier for each polygon), with a variable indicating the building being constructed as part of the conversion process. *SAS* implemented macro calls %annomac (required for annotations) and *%centroid* (finds centroids of a given dataset) enable annotations of room numbers within the output floor plans. The *POLYGON* plotting statement is used within *PROC SGPLOT* on the converted shape data set to output it to an *HTML file*, including an image map to make various rooms clickable. These form the foundation for the landing point on each building inside the dashboard.

4 Data Cleaning and Validation

Significant cleaning of the data is required in order to prepare it for use in the reports. Not surprisingly, there are some variations (as well as errors) in how the courses have been entered into the university system over the years.

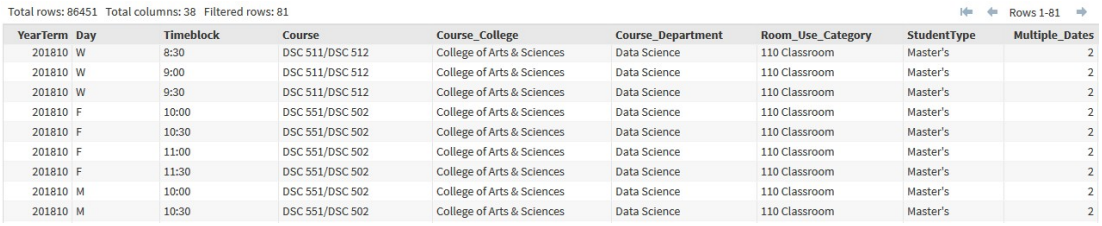
Further organization of the data includes expanding each course listing to produce one observation for each day that a given course is scheduled. For example, if a course is taught on Monday, Wednesday, and Friday, the final dataset will include an observation for that

course for Monday, an observation for Wednesday, and an observation for Friday. New variables are added to track the level of the course (undergraduate versus graduate) and to keep track of starting dates and ending dates of courses (to account for half semester courses), along with the semester and year. Formats and attributes are set for all the variables, and finally all the building datasets are concatenated in order to gain a full picture of course bookings. It should be noted that any course listings that are missing entries for meeting days, meeting places, enrollment, or room capacity are deleted, as those are either online courses that do not affect physical room booking analysis or are unable to be analyzed due to the lack of necessary information. The data is validated by two separate teammates, wherein *PROC COMPARE* is performed to compare both of the independently programmed datasets to ensure that the final dataset is accurate. ***Figure 2*** shows the data once it has been cleaned.



snapshot_term_	snapshot_nai	sect_term_cod	sect_term_	course_	crn_	course_abbrev	course_credit_ca	course_credi	course_level_	course_level	section_start	section_end_	schedule_type_co
20186	Fall 2018 Census	201910	Fall 2018	502DSC	11955	DSC 502	1	Resident Credit	4	Master's	10/15/2018	12/7/2018	LEC
20186	Fall 2018 Census	201910	Fall 2018	551DSC	11954	DSC 551	1	Resident Credit	4	Master's	8/22/2018	10/12/2018	LEC
20186	Fall 2018 Census	201910	Fall 2018	592DSC	11957	DSC 592	1	Resident Credit	4	Master's	10/15/2018	12/7/2018	LEC
20186	Fall 2018 Census	201910	Fall 2018	501DSC	11956	DSC 501	1	Resident Credit	4	Master's	8/22/2018	10/12/2018	LEC
20186	Fall 2018 Census	201910	Fall 2018	101UNI	12759	UNI 101	1	Resident Credit	1	Lower division undergradu	8/22/2018	12/7/2018	LEC
20186	Fall 2018 Census	201910	Fall 2018	511DSC	11952	DSC 511	1	Resident Credit	4	Master's	8/22/2018	10/12/2018	LEC
20186	Fall 2018 Census	201910	Fall 2018	512DSC	11953	DSC 512	1	Resident Credit	4	Master's	10/15/2018	12/7/2018	LEC
20186	Fall 2018 Census	201910	Fall 2018	502DSC	11955	DSC 502	1	Resident Credit	4	Master's	10/15/2018	12/7/2018	LEC
20186	Fall 2018 Census	201910	Fall 2018	551DSC	11954	DSC 551	1	Resident Credit	4	Master's	8/22/2018	10/12/2018	LEC
20186	Fall 2018 Census	201910	Fall 2018	501DSC	11956	DSC 501	1	Resident Credit	4	Master's	8/22/2018	10/12/2018	LEC
20186	Fall 2018 Census	201910	Fall 2018	592DSC	11957	DSC 592	1	Resident Credit	4	Master's	10/15/2018	12/7/2018	LEC
20186	Fall 2018 Census	201910	Fall 2018	542DSC	11958	DSC 542	1	Resident Credit	4	Master's	8/22/2018	12/7/2018	PRA
20186	Fall 2018 Census	201910	Fall 2018	142MAT	12017	MAT 142	1	Resident Credit	1	Lower division undergradu	8/22/2018	12/7/2018	LEC
20186	Fall 2018 Census	201910	Fall 2018	141MAT	12003	MAT 141	1	Resident Credit	1	Lower division undergradu	8/22/2018	12/7/2018	LEC
20186	Fall 2018 Census	201910	Fall 2018	141MAT	12008	MAT 141	1	Resident Credit	1	Lower division undergradu	8/22/2018	12/7/2018	LEC
20186	Fall 2018 Census	201910	Fall 2018	345MAT	12057	MAT 345	1	Resident Credit	2	Upper division undergradu	8/22/2018	12/7/2018	LEC

Figure 1: Screenshot of raw data showing one section of a course.



Total rows: 86451 Total columns: 38 Filtered rows: 81 Rows 1-81

YearTerm	Day	Timeblock	Course	Course_College	Course_Department	Room_Use_Category	StudentType	Multiple_Dates
201810	W	8:30	DSC 511/DSC 512	College of Arts & Sciences	Data Science	110 Classroom	Master's	2
201810	W	9:00	DSC 511/DSC 512	College of Arts & Sciences	Data Science	110 Classroom	Master's	2
201810	W	9:30	DSC 511/DSC 512	College of Arts & Sciences	Data Science	110 Classroom	Master's	2
201810	F	10:00	DSC 551/DSC 502	College of Arts & Sciences	Data Science	110 Classroom	Master's	2
201810	F	10:30	DSC 551/DSC 502	College of Arts & Sciences	Data Science	110 Classroom	Master's	2
201810	F	11:00	DSC 551/DSC 502	College of Arts & Sciences	Data Science	110 Classroom	Master's	2
201810	F	11:30	DSC 551/DSC 502	College of Arts & Sciences	Data Science	110 Classroom	Master's	2
201810	M	10:00	DSC 551/DSC 502	College of Arts & Sciences	Data Science	110 Classroom	Master's	2
201810	M	10:30	DSC 551/DSC 502	College of Arts & Sciences	Data Science	110 Classroom	Master's	2

Figure 2: Data after the cleaning and validation process is complete.

Information from a university-wide room inventory is then joined to the course listing dataset in order to add square footage and room ownership information for each room. This is done in *PROC SQL*, joining the two datasets on the name of the building and room number.

5 Visualization

The analysis of this work culminates in an interactive dashboard that allows users to observe the trends in teaching space utilization over time. The dashboard initially includes eleven buildings at a university, which house different academic departments. Clicking on any of these buildings brings the user to a page that shows the floor plans for one floor of the

building, with options displayed to allow the user to select the desired academic year and semester, the level of the building, along with the different color gradient legends. Once the semester and level of the building are selected, the dashboard brings the user to a visualization of the floor plans displaying overall percent use, or how often a room is booked during the hours of 8 AM to 9PM on Monday to Thursday and 8am to 3pm on Friday (henceforth referred to as prime time) for each room for the specified semester. By clicking on each room, the user is able to access a selection of four reports describing the space utilization and scheduling of that room. The reports include a heat mapped classroom calendar, with the heat mapping reflecting the percentage of the room capacity used for the chosen semester. A stacked bar graph is displayed to show the distribution of hours among departments for that semester. A horizontal bar graph on historical trends of the percentage of capacity used across paneled by Fall/Spring semesters is included. Finally, a report of daily capacity percentages that included all other rooms in the same room size bin for comparing the efficiency of scheduling. Each report can be clicked on to expand the display to fill the window. ***Figure 3*** below illustrates screenshots from the dashboard, and the entire dashboard can be viewed at **https://superfreqs.github.io/UniversityCSU/.**

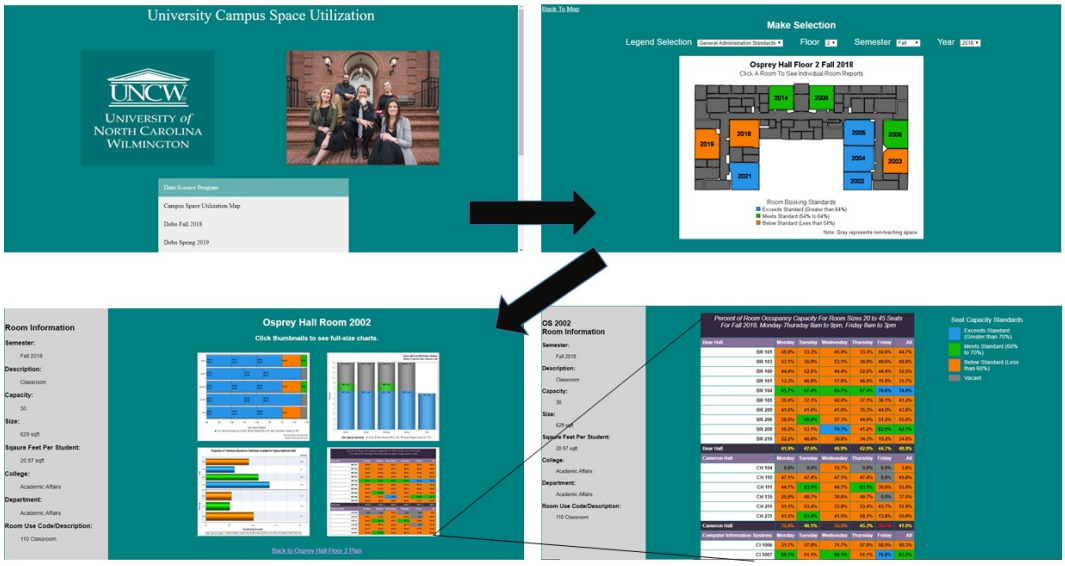


Figure 3: Screenshot of the flow of the website. The user chooses a building from the home page (pictured here is Osprey Hall) and is brought to a selection menu allowing the user to select a year, semester, building floor and legend version (default is a percentage color gradient for the first floor of the building for Fall 2017). By clicking a room, the user is brought to a dashboard showing reports and graphs, each of which can be expanded by clicking on it.

6 Generalization

While this dashboard is currently configured to analyze teaching space at the university level and would be applicable to the needs of any university, it could also readily translate to any organization or entity that needs to manage a large amount of activity across a large amount of space, possibly such as a hospital or campus of a large company. Public school systems could also benefit from a tool that provides a look at both past space utilization as well as current trends in how classrooms and other spaces are used.

7 Suggestions for Future Work

There are many potential additions to this dashboard that can be made to enhance its utility, as it just begins to scratch the surface of trends in room usage at the university level. An obvious path forward is to include as many buildings on a campus as possible including a wide variety of space open for reservations, not purely classrooms in academic buildings. Optimization of room bookings is also a long-term goal for the tool described here.

Such optimization would likely include a model that would identify rooms to be used to alleviate pressure from chronically over-used rooms and make suggestions based on rooms that are chronically under-utilized. Because room ownership can be contentious, a future version of this dashboard could potentially include a summary of the growth of the academic departments including both students and faculty. The dashboard could also be modified to display results based on projected and/or simulated growth. Ideally, this dashboard would include a complete picture of the special characteristics available in all rooms, which would be of particular help in placement of more specialized courses; whether it be a small graduate class that needs only a handful of seats or a computer programming class that requires access to a computer lab.

The data is what ultimately drives any dashboard and, obviously, the better the data, the better the dashboard will be. As discussed previously, the course listings over the past 10 years contain errors and variations of how courses were entered. Uniform entry of the course listings, as well as continuous, detailed, and accurate room inventory data, is essential for the success of the dashboard and any future models that could be added.

8 Conclusion

An interactive dashboard is created in order to visualize and understand trends in room usage across a university campus. The goals of this dashboard are such that the utilization of space at the university is well understood, and that it could potentially inform future room bookings and planned construction. The dashboard has been configured so that it is both informative and aesthetically pleasing, and it can easily translate to any other entity that has space management needs.

9 References

Robert Allison's SAS/Graph Examples! Accessed January 19, 2018, http://robslink.com/SAS/Home.htm

10 Acknowledgments

A special thanks to Dr. Jim Blum for his amazing mentorship and Andrew Kimrey for guidance on web design.

11 Contact Information

Your comments and questions are valued and encouraged.

Michelle Page
UNC Wilmington
https://www.linkedin.com/in/michelle-page/

Hilary Melroy
UNC Wilmington
https://www.linkedin.com/in/hilary-melroy/

Brittany Palmer
UNC Wilmington
https://www.linkedin.com/in/palmer-brittany/

Greg Terlecky
UNC Wilmington
https://www.linkedin.com/in/greg-terlecky/

USER GUIDE

1. Introduction

This User Guide (UG) provides guidance and information intended for users of the University Campus Space Utilization (CSU) web-based dashboard. Included in the UG will be instructions on how to update the website and supporting programs for future analysis. This UG will walk through how to use the final deliverable, the web-based dashboard.

This UG is applicable to the following link:
https://superfreqs.github.io/UniversityCSU/index.html

2. Overview

2.1 Important Contacts

SAS SuperFREQ Team

Michelle Page
M.S. Data Science
mlp7799@uncw.edu

Hilary Melroy
M.S. Data Science
hrm1886@uncw.edu

Brittany Palmer
M.S. Data Science
bap2578@uncw.edu

Greg Terlecky
M.S. Data Science
gst8882@uncw.edu

Director, *Data Science Program*	Mark Lammers (lammersm@uncw.edu)
Faculty Advisor, *M.S Data Science Program*	Jim Blum (blumj@uncw.edu)
Associate Provost, *Office of Institutional Research and Planning*	Andrew Mauk (mauka@uncw.edu)
Space Planner, *Office of Institutional Research and Planning*	Woody Sutton (suttonc@uncw.edu)
Academic Space Manager, *Office of Institutional Research and Planning*	Tina Strickland (stricklandt@uncw.edu)
Facilities Coordinator, *Office of Institutional Research and Planning*	Audry Nunnally (nunnallya@uncw.edu)
Manager of Institutional Research Reporting Services, *Office of Institutional Research and Planning*	Carlene Jackson (jacksoncc@uncw.edu)

2.2 Data Repository

All the supporting content for the web-based dashboard is located in two places.

1. Dr. Jim Blum's SeaShare Drive:
   \\seashare\blumj\Data Science Work Folder\SeaNet\OIR Practicum

   [Note: In order to gain access to this folder, please contact Dr. Blum]

2. Tina Strickland's Shared OneDrive (SPM Data Science Student Practicum)

   https://uncw4-my.sharepoint.com/:f:/g/personal/stricklandt_uncw_edu/EmO-sa0oDh9LjSk9UXtw0zEBCIPuInHHU6pti7cIE1hK0Q?e=MBHAr3

[Note: The link above will work for anyone with UNCW credentials. But in order to write or modify any content to this OneDrive, you will need to contact Tina Strickland for access]

2.3 Special Considerations

You will need the following programs/tools available in order to update the website:

1. SAS 9.4 (with Maintenance Release 4 or higher) or SAS Studio 3.5
2. JavaScript
3. HTML
4. CSS
5. GitHub

To view the website, you will only need access to a web browser and an internet network source.

3. Updating Supporting Programs

3.1 Access Needed

Before starting any needed updates to the supporting programs, you will need to make sure that you have access to the following systems:

- SAS 9.4 (Maintenance Release 4 or higher)
- Location of the data repository (see section 2.2 for information and ownership of these repositories)
- GitHub Account (https://github.com/)
  [Note: We have found it easiest to download the GitHub Desktop App]

3.2 Data Sourcing

The current website holds CSU data from the fall semester of 2015 to the 2018 fall semester.

The data will come from a combination of the Banner database and the Student Data Mart (SDM).

You will need to contact Carlene Jackson in the Office of Institutional Research and Planning with the following information to extract a new data request:

- Semester and year of new data (i.e. Spring 2019/Fall 2019)
- Buildings of interest [if not for a specific request, please pull all buildings with academic classes in them]

The new data request will be uploaded to the SPM Data Science Student Practicum OneDrive. Each building will have its own sheet within the workbook. All naming conventions for the data will follow this format, "BUILDING_SDM".

The following variables should be in them named EXACTLY how it is below:

Variable Name		
snapshot_term_code	schedule_type_code_inst	building_code_inst
snapshot_name	schedule_type_inst	building_desc_inst
sect_term_code_inst	section_actual_enrollment	building
sect_term_inst	section_capacity	section_college_code
course_key	section_credit_hours	section_college
crn_id	instruction_method_code_inst	section_department_code
course_abbreviation	instruction_method_inst	section_department
course_credit_cat_code	instructional_format_code	daytime_usage_flag
course_credit_cat	instructional_format	nighttime_usage_flag

Variable Name

course_level_code	link_indicator	sunday
course_level	beginning_hour	monday
section_start_date	ending_hour	tuesday
section_end_date	hours_per_week	wednesday
Thursday	section_combined_type_code	room_use_code
Friday	section_combined_type	room_use_desc
Saturday	instructor	section_combined_flag
section_meeting_pattern	section_hours_contact	section_combined_id
Room	section_hours_lecture	primary_instr_flag
room_code_inst	section_hours_lab	pct_responsible
room_desc_inst	section_hours_other	
room_capacity	room_nbr	

In order for the code to run properly, please make sure that all variable names match up with the new data request.

3.3 SAS Programs

You will need to run all SAS Programs in the following order in order for it to execute properly.

- 1 General Data Creation.sas
- 2 Stats Subsets Creation.sas
- 3 Create Floor Plan Map data.sas
- 4 SideBar Macro Store.sas
- 5 Heat Mapped Floorplans.sas
- 6 Class Sched Graph.sas
- 6 Room Capacity Reports.sas
- 6 Subjects Stacked Bar Graph.sas
- 6 Time Series Panel By.sas
- 7 Room Info Grids.sas

Within each program will be a standard header to explain important attributes.

- Program Name: What the SAS program is named
- Order to Run: In what order the program should be run
- Category [Data, Graphs/Reports, etc.]: This will categorize the program to what it helps to produce. The data category denotes that the program helps to create the base data for the website. The "Graphs/Reports" category denotes that the program outputs information regarding the individual graphs/reports within the website.
- Purpose: This will give a small introduction on why the program was created and what it will produce.
- Libraries Read From: Some programs will pull from datasets created in prior programs. “Libraries Read From” will inform you on where the program is pulling data from.
- Libraries Output To: This will indicate where datasets produced by the program will be stored for future use.

Some programs include user-created macros. Information regarding these specific macros will be denoted and explained within the appropriate program below. This information will include what input parameters will be required to run the macro successfully. It will also describe what parameters will be created by the macro.

There will be a section at the end of each program description for any notes or special considerations you may need to take into account when updating or running the program.

3.3.1 General Data Creation

PROGRAM OVERVIEW:

Program Name:	1 General Data Creation.sas
Order to Run:	First
Category:	Data
Purpose**:**	Create a clean dataset of all buildings schedules with necessary variables
Libraries Read From:	BUILDING, ROOM
Libraries Output To:	OUTPUT

MACRO: *%CLEAN*

Purpose:	Creates a temporary clean dataset (SCHED_TMP2) for each building from importing the raw data and making necessary transformations. SCHED_TMP2 is used in the second macro to combine all semesters into one dataset.
Input Parameters:	NONE
Parameters Called:	*&DATA* = name of each building sheet in excel data set. (From macro %*COMBINE*)
Parameters Created:	NONE

MACRO: *%COMBINE*

Purpose:	This macro calls %*CLEAN* for each building in the list of buildings and combines all buildings into one big data set. (NOTIMEBLOCKS)
Input Parameters:	*DATASET* = building abbreviations of each sheet in excel dataset, separates names using the "|" as the delimiter.
Parameters Called:	NONE
Parameters Created:	*DATA*= individual building name to pass to the Macro *%CLEAN*

MACRO: *%TIMEBLOCK*

Purpose:	This separates each class meeting into half-hour time blocks and deals with any overlapping meeting times. This creates and outputs the final data set. (*output*.TIMEBLOCKS).
Input Parameters:	NONE
Parameters Called:	NONE
Parameters Created:	NONE

NOTES/MISC:

ADD ROOM DATA:	This section takes all of the data sets with info about campus rooms and combines them into one dataset so this can be added to the NOTIMEBLOCK dataset. Then this data set will have accurate room info for each course meeting time. The final dataset is called NOTIMEBLOCK and it is stored in the OUTPUT library for future use with creating graphs and analysis.

3.3.2 Stats Subsets Creation

PROGRAM OVERVIEW:

Program Name:	2 Stats Subsets Creation.sas
Order to Run:	Second
Category:	Data
Purpose**:**	Create analysis data sets used to create graphs and reports
Libraries Read From:	INPUT
Libraries Output To:	OUTPUT

SECTION: ROOM CAPACITY

Purpose:	Calculates seat capacity for each day and the overall week. Capacity is computed by seats occupied divided by total seats available (including the time when the room is not booked) for each day/week. One record for each day and week is output.
Dataset Created:	*output*.ROOM_CAPACITIES

SECTION: CALENDAR LAYOUT

Purpose:	Calculates seat capacity for each course time (seat occupied divided by room capacity). One record for each class meeting time is output along with any vacant time which will have an observation (created shell of the week to get this).
Dataset Created:	*output*.CALENDAR_LAYOUT

SECTION: SUBJECT USE

Purpose:	Calculates the number of hours each subject meets in prime time and the seat capacity percent for this time. Data is set up to output one record per subject, per room, per term and vacant hours are recorded at the end (appears on top for subject bar graph).
Dataset Created:	*output*.SUBJECT_USE

SECTION: SEMESTER ROOM USE

Purpose:	Calculates room use percent which are hours booked in a week/total hours in prime time definitions and Room Capacity Percent is computed by seats occupied in a week divided by total seats available (only for the time when room is booked) for the week per semester. One observation per room per year/term is output.
Dataset Created:	*output*.SEMESTER_ROOM_USE

NOTES/MISC:

FORMATS:	Create format and attribute datasets. Data steps using *DATALINES* to create data does not run well in batch mode so run these interactively and comment them out before batch submitting.

3.3.3 Create Floor Plan Map Data

PROGRAM OVERVIEW:

Program Name:	3 Create Floor Plan Map data.sas
Order to Run:	Third
Category:	Data
Purpose**:**	Create analysis data sets used to create heat mapped floorplans and contain coordinates needed to draw floor plans.
Libraries Read From:	INPUT, ROOM
Libraries Output To:	INPUT

MACRO: *%FLOORPLANDATA*

Purpose:	Reads in shapefiles to create a map dataset with all coordinates needed to draw each floorplan. Uses OBJECTID/ROOMNUMBER to identify room polygons. Room information in the data set is then merged to the map dataset for those rooms only. Includes Room Use Percent that is obtained from the analysis dataset *input*.SEMESTER_ROOM_USE.
Input Parameters:	NONE
Parameters Called:	NONE
Parameters Created:	&*SHAPEFILE* = names of shapefiles (loops through using counter n, uses &SHAPEMAX to determine max) &*YEARTERM*= Yearterm variable (loops through using counter y, uses &*TERMMAX* to determine max) &*BUILDINGNAME*= Building_Title &*FLOOR*=Floor Number &*BUILDING*=Building abbreviation

NOTES/MISC:

ADD ROOM DATA:	This section takes all of the data sets with information about campus rooms and combines them into one dataset so this can be added to the map dataset. Then this data set will have some room info for rooms not in our schedule data sets. The final dataset is called *input*.FLOORPLAN_MAPS.
FLOORPLAN FILE NAMES:	In the first data step, a new variable is created to be further used to call shapefiles. Not all shapefile names match the building title in our data so this is adjusted when creating the ShapeFile variable. If new shapefiles are added it is important to check and adjust this data step as needed.
BUILDING SUBSET:	In the first data step that pulls in the data to be used for the graph, the data is subset in the where statement(where building in ('BR','CH','DL', 'DO', 'FA', 'LH', 'MO', 'OS','CI','MC','TL');) by listing all building abbreviations of buildings that have accessible floorplans. Map data can only be generated for buildings with available floorplan shapefiles.

3.3.4 Side Bar Macro Store

PROGRAM OVERVIEW:

Program Name:	4 SideBare Macro Store.sas
Order to Run:	Fourth
Category:	Graphs/Reports
Purpose**:**	Create a global macro that will set universal parameters, options, formats, and create an informational sidebar for each room, the 4 room graphs, and the room grid. It will also loop through all rooms, semesters, years, and legend versions to create specified graph/report output for each combination.
Libraries Read From:	INPUT
Libraries Output To:	NONE

MACRO: *%SIDEBAR*

Purpose:	Sets all formats used for labels, titles, and colors. Creates or pulls in color attribute data sets to the work library. Loops through all combinations of rooms, yearterms, and legend version to create an html page for each. Stores important room info as macro parameters that will utilize in sidebar and in each graph code. Creates a standard layout for all room html pages, including grey side bar with room information and back to previous page bottom link. Calls specified graph macro to determine which graph/report to insert into page. Stores macro in input library so it can be called in other programs.
Input Parameters:	*GRAPH*= the first part of the file name to differentiate between graphs for a room/ identifies type of graph. This parameter is left blank when running the room grid macro because no graphs are being created. (Current options: *sched_ , report_ , series_ , stack_*) *DATA*= Name of data set used to create graphs/reports. *OUTPUTPATH*= path want to output html pages to. (Default=C:\Users\bap2578\Documents\GitHub\UniversityCSU\FloorPlans\Grids) *INSIDEMACRO*= Name of macro used that generates the graphs/reports. *TIMEVERSION*= Used only with the *%CLASSSCHEDULE* macro! Identifies which time range currently generating Graphs for, 1 = 8am-4pm ; 2 = 4pm - 9pm.
Parameters Called:	NONE
Parameters Created:	&*STARTTIME*= '8:00't; &*ENDTIME*= '16:00't ; &*TIMENAME*=; &*ROOMID* = Identifies Building, Room Number, and *year term* needed to name links/files (loops through using counter n, uses &ROOMMAX to determine max) &*BUILDINGNAME* = Building_Title &*ROOMNUMBER* = RoomNumber &*YEARTERM* = YearTerm &*SEMESTERYEAR* = put(YearTerm,yrtrm.)

&*ROOMDEPARTMENT* = Room_Department
&*ROOMCOLLEGE* = Room_College
&*FLOOR* = Floor Number
&*SQFT* = sqft
&*ROOMTYPE* = Room_Type
&*ROOMCAP* = RoomCap
&*BUILDING* = Building Abbreviation
&*ROOMBIN* = Room Size Bin
&*ROOMUSE* = Room Use Code/ Room Use Category description
&*SQFTRATIO* = SQFT/RoomCap
%if &INSIDEMACRO=ROOMCAPACITY %then %do;
SIDETITLE = Adds Room Name to side title only for room capacity reports, the other graphs include this in their title
&*V* = 1 represents Color Gradient option for legend and 2 represents Standards legend. Macro uses this to loop through html code twice to output each legend version (2 total) for each graph.
&*VERSION*= Identifies which legend version currently using in loop to create graph, also acts as an identifier in the html file name by adding nothing(leaving version=; to keep the default page name consistent) to end of the file or adding standards for the legend displaying the standards.
&*COLORMAP*= Identifies the *colormap* and legend options that are stated in the *PROC SGPLOT* statement
&*COLORRESPONSE*= Identifies the *colorresponse* variable and type of color response to be used for the graph, for the standards legend this also includes the grouping needed to go along with the *attrid* option
&*LEGEND*= The full legend statement for the specific type of legend generating
&*STANDARDFORMAT* = Identifies the standards variable and the corresponding format for the standards legend, left blank for color gradient legend.
&*LEGENDBORDER*= identifies option of *nolegendborder* in legend statement if specified for current graph
&*REPORTLEGEND*= identifies variable to use to create report legend
&*LEGENDTITLE*= Identifies part of the legend title that depends on the type of legend for the room capacity reports

NOTES/MISC:
The many Macro Parameters that are created but not used are available and needed to be used inside the certain graph macros (&*INSIDEMACRO*) called within this macro.

3.3.5 Heat Mapped Floorplans

PROGRAM OVERVIEW:

Program Name:	5 Heat Mapped Floorplans.sas
Order to Run:	Fifth
Category:	Graphs/Reports
Purpose**:**	Create a heat mapped floorplan which shows the hours booked percent as the color response. Create one output per building, floor, year/term, and legend version. Includes drop-down to select these choices.
Libraries Read From:	INPUT
Libraries Output To:	NONE

MACRO: *%FLOORPLAN*

Purpose:	Creates dropdown menu for choosing Legend version, Floor, Semester, and Year using HTML and JavaScript. Then creates the heat mapped floorplan using the polygon statement in *SGPLOT* and makes the rooms clickable (goes to room grid page next). Macro is used to loop through all buildings, legend versions, possible floors, years, and semesters to create one output for each combination.
Input Parameters:	*&OUTPUT*= path want to output html pages to. Make sure in floorplans folder!
Parameters Called:	NONE
Parameters Created:	*&FLOORID* = Identifies Building, Floor Number, and yearterm needed to name links/files (loops through using counter n, uses &FLOORSMAX to determine max) *&BUILDINGNAME* = Building_Title *&YEARTERM* = YearTerm *&FLOOR*=Floor Number *&BUILDING*=Building abbreviation *&TERM* = Number corresponding to term in yearterm variable, so 10= fall and 20=spring *&YEAR* = Year *&V* = 1 represents Color Gradient option for legend and 2 represents Standards legend. Macro uses this to loop through html code twice to output each legend version (2 total) for each graph. *&VERSION*= Identifies which legend version currently using in loop to create graph, also acts as an identifier in the html file name by adding nothing(leaving version=; to keep the default page name consistent) to end of the file or adding standards for the legend displaying the standards. *&COLORMAP*= Identifies the colormap and legend options that are stated in the *PROC SGPLOT* statement *&COLORRESPONSE*= Identifies the color response variable and type of color response to be used for the graph, for the standards legend this also includes the grouping needed to go along with the *attrid* option *&LEGEND*= the full legend statement for the specific type of legend generating

&STANDARDFORMAT = Identifies the standards variable and the corresponding format for the standards legend, left blank for color gradient legend.
&ROOMLINK= Identifies correct link to use for each room that corresponds with current legend, so if standards legend then want *roomlink* to be =RoomLink_Standard and for color gradient it is just *roomlink*
&VERSIONSELECTIONS = stores legend version drop down selections identifying which one should be selected, etc.
&FLOORSELECTIONS = stores Floors drop down selections identifying which one should be selected, etc.
&SEMESTERSELECTIONS = stores Semesters drop down selections identifying which one should be selected, etc.
&YEARSELECTIONS = stores years drop down selections identifying which one should be selected, etc.

NOTES/MISC:
Output is only created for buildings with working floorplan shapefiles. The data is subset for this in the SAS Program (3 Create Floor Plan Map data.sas) and if more floorplans become accessible then this code needs to be adjusted according to the program's header notes to add more buildings to this output.

3.3.6 Class Schedule Graph

PROGRAM OVERVIEW:

Program Name:	6 Class Sched Graph.sas
Order to Run:	Sixth (Can be run simultaneously with any program with prefix '6')
Category:	Graphs/Reports
Purpose**:**	Creates an HTML page using the website's standard web page layout set by the macro *%SIDEBAR* and inserts a graph displaying a week's schedule of courses for one room/semester/year/legend version. The blocks representing the course time periods are labeled with the course(s) and colored according to the seat capacity percent for that time period. A drop down is also created to choose between 2-time ranges: 8-4pm and 4pm-9pm.
Libraries Read From:	INPUT
Libraries Output To:	NONE

MACRO: *%CLASSSCHEDULE*

Purpose:	Creates HTML region to be inserted into html page that *%SIDEBAR* creates. The 2 parts of this region consists of a drop down menu and week course schedule graph. The drop-down contains 2 choices for the time ranges. The schedule graph is created using the high-low statement in *SGPLOT* using adjusted start and end times of all courses, overlapping courses are accounted for in cleaning data so no issues should arise here. Vacant time periods are not labeled and are colored grey. Footnotes are set to

	conditionally point out part term courses if the graph contains any. In the color bar version the footnotes identifies the grey is for vacancies. The x-axis is the course times and the y-axis is the days.
Input Parameters:	NONE
Parameters Called:	*&DATA*= Name of data set used to create graphs/reports.
Parameters Created:	*&PARTTERM* = Used to identify if part term courses are included in graph, if so this variable will be greater than 1. *&TIMESELECTIONS* = stores time range drop down selections identifying which one should be selected, etc.

NOTES/MISC:

SIDEBAR MACRO:	Call %SIDEBAR MACRO to setup an html page using the universal website's standard web page layout set and it will insert output from what first macro in program creates. This will loop through and create all outputs for all room, yearterms, and legend version combinations. This is called twice to produce the 8-4 graphs and then the 4-9 graphs.
BUILDING SUBSET:	In the first data step that pulls in the data to be used for the graph, the data is subset in the where statement(where building in ('BR','CH','DL', 'DO', 'FA', 'LH', 'MO', 'OS','CI','MC','TL');) by listing all building abbreviations of buildings that have accessible floorplans. Currently, there is no way to link room graphs to the website without a building floorplan page. If more floorplans become accessible then add the building abbreviation to this list.

3.3.7 Room Capacity Reports

PROGRAM OVERVIEW:

Program Name:	6 Room Capacity Reports.sas
Order to Run:	Sixth (Can be run simultaneously with any program with prefix '6')
Category:	Graphs/Reports
Purpose**:**	Creates a HTML page using the website's standard web page layout set by the macro *%SIDEBAR* and inserts a report/table that displays the seat capacity percentages for each day of the week and the overall week seat capacity percentage for all rooms in the same room size bin(i.e. under 20, etc.). The background color of the cells of the percentages is colored based on the seat capacity percent.
Libraries Read From:	INPUT
Libraries Output To:	NONE

MACRO: *%ROOMCAPACITY*

Purpose:	Creates HTML region to be inserted into html page that *%SIDEBAR* creates. The 2 parts of this regions consist of a report/table displaying seat capacity percent's and a table for the colors legend. The seat capacity table includes all rooms in the same room size bin and only displays percentages for the current semester the room grid page is

	on (previous page). In the report the rooms are divided by building by inserting a row before each building labeling the building title in the first column and then labeling Monday-Friday and an All column in the rows preceding. A summary row after each building is inserted displaying the day or week's mean percentage for that building. The second report to the side creates a table displaying the colors used in one column and the color's label in the second column. Both tables are created using *PROC REPORT*.
Input Parameters:	*&OUTPUTPATH*= path want to output html pages to.
Parameters Called:	*&DATA*= Name of data set used to create graphs/reports.
Parameters Created:	NONE

NOTES/MISC:

SIDEBAR MACRO:	Call *%SIDEBAR* macro to setup an html page using the universal website's standard web page layout set and it will insert output from what first macro in program creates. This will loop through and create all outputs for all room, yearterms, and legend version combinations.
BUILDING SUBSET:	In the first data step that pulls in the data to be used for the graph, the data is subset in the where statement(where building in ('BR','CH','DL', 'DO', 'FA', 'LH', 'MO', 'OS','CI','MC','TL');) by listing all building abbreviations of buildings that have accessible floorplans. Currently, there is no way to link room graphs to the website without a building floorplan page. If more floorplans become accessible then add the building abbreviation to this list.

3.3.8 Subjects Stacked Bar Graph

PROGRAM OVERVIEW:

Program Name:	6 Subjects Stacked Bar Graph.sas
Order to Run:	Sixth (Can be run simultaneously with any program with prefix '6')
Category:	Graphs/Reports
Purpose**:**	Creates an HTML page using the website's standard web page layout set by the macro *%SIDEBAR* and inserts a stacked bar graph displaying hours utilized by different course subjects per room and semester. The bars are colored according to seat capacity percent for when that subject meets.
Libraries Read From:	INPUT
Libraries Output To:	NONE

MACRO: *%SUBJECTUSE*

Purpose:	Creates a stacked bar graph to be inserted into html page that %SIDEBAR creates. The graph displays 5 bars for each day (day on x-axis) and hours on the y-axis (1-13). Each bar is split up by the subjects utilizing that room on that day and each block is labeled with the subject and the specific

	hour amount it is utilized. Vacant time is displayed on the top of each bar, if there is any on that day. Amount of hours looked at for each day follows the primetime definitions of M-R, 8am-9pm; F, 8am-3pm. The *highlow* statement in *SGPLOT* is used to create the subject bars.
Input Parameters:	NONE
Parameters Called:	*&ROOMID* = Identifies Building, Room Number, and yearterm needed to name links/files
Parameters Created:	NONE

NOTES/MISC:

SIDEBAR MACRO:	Call *%SIDEBAR* macro to setup an html page using the universal website's standard web page layout set and it will insert output from what first macro in program creates. This will loop through and create all outputs for all room, yearterms, and legend version combinations.
BUILDING SUBSET:	In the first data step that pulls in the data to be used for the graph, the data is subset in the where statement(where building in ('BR','CH','DL', 'DO', 'FA', 'LH', 'MO', 'OS','CI','MC','TL');) by listing all building abbreviations of buildings that have accessible floorplans. Currently, there is no way to link room graphs to the website without a building floorplan page. If more floorplans become accessible then add the building abbreviation to this list

3.3.9 Time Series Panel

PROGRAM OVERVIEW:

Program Name:	6 Time Series Panel.sas
Order to Run:	Sixth (Can be run simultaneously with any program with prefix '6')
Category:	Graphs/Reports
Purpose**:**	Creates an HTML page using the website's standard web page layout set by the macro *%SIDEBAR* and inserts a horizontal bar graph representing each semester's total room use proportions. The graph is paneled by semester so fall semesters are on top and spring semesters are on the bottom. The bars are colored according to seat capacity percent for that semester.
Libraries Read From:	INPUT
Libraries Output To:	NONE

MACRO: *%TIMESERIES*

Purpose:	Creates a panel horizontal bar graph to be inserted into the html pages that *%SIDEBAR* creates. The y-axis displays a label for the Fall/Spring semester and then a row axis table is used to label the years between the semester label and the bars. Another row axis table is inserted at the right end of the graph to the room use percentages in decimal format. The x-axis displays the room use proportions. The bars are colored according the semester seat capacity

	(which is out of when the room is booked and not all hours it is available). *PROC SGPANEL* is used along with the *hbar* statement to build the bar graph.
Input Parameters:	NONE
Parameters Called:	*&ROOMID* = Identifies Building, Room Number, and yearterm needed to name links/files
Parameters Created:	NONE

NOTES/MISC:

Data Manipulation:	A shell of the years that room is available is made before the *%TIMESERIES* Macro so years on the x-axis do not randomly skip.
Sidebar Macro Call:	Call *%SIDEBAR* to setup an HTML page using the universal website's standard web page layout stand it will insert output from what first macro in program creates. This will loop through and create all outputs for all room, yearterms, and legend version combinations.
BUILDING SUBSET:	In the first data step that pulls in the data to be used for the graph, the data is subset in the where statement(where building in ('BR','CH','DL', 'DO', 'FA', 'LH', 'MO', 'OS','CI','MC','TL');) by listing all building abbreviations of buildings that have accessible floorplans. Currently, there is no way to link room graphs to the website without a building floorplan page. If more floorplans become accessible then add the building abbreviation to this list

3.3.10 Room Info Grids

PROGRAM OVERVIEW:

Program Name:	7 Room Info Grids.sas
Order to Run:	Seventh
Category:	Graphs/Reports
Purpose**:**	Creates an HTML page that lays out clickable squares of 4 individual room graphs/reports and displays room info in the sidebar using the macro *%SIDEBAR*.
Libraries Read From:	INPUT
Libraries Output To:	NONE

MACRO: *%ROOMGRID*

Purpose:	Inputs 4 medium sized images in grid layout of each of the rooms' graphs/reports and makes them clickable to lead to that graph.
Input Parameters:	NONE
Parameters Called:	*&BUILDINGNAME* = Building_Title
Parameters Created:	NONE

NOTES/MISC:

SIDEBAR MACRO:	Call *%SIDEBAR* macro to setup an html page using the universal website's standard web page layout set and it will insert output from what first macro in program creates.

	This will loop through and create all outputs for all room, yearterms, and legend version combinations.
BUILDING SUBSET:	In the first data step that pulls in the data to be used for the graph, the data is subset in the where statement(where building in ('BR','CH','DL', 'DO', 'FA', 'LH', 'MO', 'OS','CI','MC','TL');) by listing all building abbreviations of buildings that have accessible floorplans. Currently, there is no way to link room graphs to the website without a building floorplan page. If more floorplans become accessible then add the building abbreviation to this list.

3.4 GitHub

Once all programs have been run and checked for errors, all HTML outputs will need to be pushed to the GitHub repository for use. You will need to follow the below in order to successfully upload to the repository.

Get a GitHub Account. GitHub accounts are free and easy to use. You can create an account here: https://github.com/

Once you have an account created, it is highly recommended that you install the GitHub desktop application for ease of use. You can download it here: https://desktop.github.com/

Next, you will need to “clone” the SAS Super FREQ repository to your own GitHub. To do this follow these instructions:

1. Open the GitHub desktop application
2. Navigate to “File” in the top left
3. From the drop-down menu, select "Clone Repository"
4. Click on the third tab labeled “URL”
5. Search for **superFREQs/UniversityCSU**
6. Click “Clone”

The cloning process will take a while. This is expected due to the number of files that are held in this repository.
Once the cloning process is complete. You will be able to upload files to the repository. In order to commit new files to the master repository, follow these steps:

1. Drag and drop all new files into the sidebar for the UniversityCSU repository
2. A summary is required. This can just be a quick note on what the changes are.
3. You may add a description if need be but is not required.
4. Click “Commit to Master”.
5. Wait, this process will take a few hours due to the number of files.

4. Using the Website

Using the interactive web-based dashboard is fun and easy to use!

To get started, open a web browser (Google Chrome/Firefox are recommended), and copy and paste the following URL into the address bar.

https://superfreqs.github.io/UniversityCSU/index.html

This will bring you to the landing page. The clickable links in the middle of the page will direct you to different links of interest.

- **Data Science Program** will bring you to the main UNCW Masters of Data Science webpage if you wish to learn more about the program.
- **Campus Space Utilization Map** will bring you to the interactive dashboard. This analysis of the utilization of classrooms across campus. This portion of the UG will primarily focus on how to navigate this dashboard.
- **Dobo Fall 2018** will bring you to a report of rooms that are vacant from 8 AM to 9 PM per day for the fall 2018 semester. This was created to help alleviate some stress that Hurricane Florence created after devastating Dobo Hall. Many classes that were being held in Dobo had to be relocated. This report helps to see where on campus is vacant in order to replace some of the Dobo classes.
- **Dobo Spring 2019** will bring you to a report similar to the fall 2018 report. This report will display vacant rooms across campus per day for the spring 2019 semester. Important room attributes are shown to help delineate what room may be an appropriate fit for misplaced Dobo classes.
- **SAS Global Forum Paper** will navigate to the paper the SAS Super FREQs submitted and presented at the 2018 SAS Global Forum. This paper and accompanying presentation were among the top eight teams to participate in the SAS Global Forum Student Symposium. This paper defines the problem, describes the analysis performed and presented results relatable to campus space utilization.
- **Executive Summary and User Guide** will bring you to the final executive summary and user guide.

4.1 Campus Space Utilization Map

After clicking on the “Campus Space Utilization Map” link, you will be directed to the main dashboard. This campus map is clickable and will drill down into further analysis for CSU.

First, hover over which campus building you would like to look at. Buildings that are ‘live’ and able to be clicked will highlight with a blue rectangle. For example, DeLoach Hall (DL) in the bottom left of the map will turn blue when you hover your mouse over it.

Continuing deeper into the dashboard, click on your building of choice (we will stick with DeLoach as an example).

Once you click on the building, a heat mapped floor plan will appear. You will have four different drop-down menus to customize in order to get the information you are looking for.

Drop Down Options:

- Legend Selection
    - Percentage Color Gradient (This will show the color gradient to reflect the seating capacity of each room within the subsequent parameter selection)
    - General Administration (GA) Standards (This will show the color gradient to reflect the room booking percentages per GA Standards within the subsequent parameter selection)
- Floor
    - This will depend on the building, but this will select the different levels of the building.
- Semester
    - Fall
    - Spring
- Year
    - Start, Fall 2015
    - End, Fall 2018

The heat-mapped floor plan will change simultaneously as the drop-down parameters are altered. The color gradients in the room specific graphs will change depending on if the “Percentage Color Gradient” or “General Administration Standards” is selected on the main building page.

If you find a room of interest, you can click on it for a more detailed breakdown. For example, if you click on DL 114 it will bring you to a webpage with a grid of graphs and a sidebar with distinct room attributes.

The sidebar of room attributes will include which semester you have chosen to look at, what kind of room it is (classroom, computer lab, special lab, etc.), the actual seat capacity of the room, square footage, the square feet per student (per GA Standards), which College owns the room, departmental ownership and the room code/ description (per GA Standards). This sidebar also flows down to the individual graphs for consistency.

You can click on each graph to enlarge it and see the full-size charts.

The top left graph shows what classes are scheduled Monday through Friday during a selected time block. The two-time blocks that you can choose are 8AM to 4PM and 4PM to 9PM. If you hover over a class in the bar chart, distinct attributes of that class will show up. These attributes include: how many credit hours the course is worth; the actual enrollment of students in the course; the class time; what the actual capacity percentage is; and what kind of course it is (lecture, lab, etc.).

The top right graph shows the subject utilization of that room by day and course subject. The graph depicts the frequency at which the room is being booked by what course subject. The bar will show what course subject is booking the room and for how long. The amount of hours a room is vacant is shown with dark gray blocks, uniformly situated above the reserved times. If you hover over a course subject, you will be shown unique information about the course subject. This information includes subject capacity (the seating capacity for the overall course subject) and student type. Student type can be

defined as undergraduate, graduate or cross-listed. Cross-listed courses are those that are instructional to both undergraduate and graduate students (i.e. STT325/STT525 Categorical Data Analysis).

The bottom left graph shows the proportion of total hours booked to the total number of hours available for the room by semester. For example, if a room is available for 60 hours in a week, but is only booked 10 hours, then the room is booked approximately 17 percent of the time. For this graph, it has been grouped by fall and spring semesters to show any potential trends. While the length of the bars shows the proportion, the color of them shows the seat capacity filled for the whole semester. You can also hover your mouse on a bar to see the year, proportion and actual seat capacity.

The bottom right graph shows a report on room occupancy for rooms across the campus of similar seating capacity. For example, DL 114 has a seating capacity of 110 so the report shows capacities for room sizes over 90 seats. Each room is color coded based on its capacity per day. This color scheme is exactly the same as all other color gradients in previous graphs.

All pages are equipped with links that will backtrack through the website. You may also use your browser back buttons, but this will cause you to go back through all webpages you have visited. It is recommended that you use the back links embedded within the webpage to avoid any confusion.

This is the end of the step-by-step guide on how to use the interactive, web-based dashboard for University Campus Space Utilization.

Appendix A: Version Control

Version Number	Date	Author/Owner	Description of Change
1.0	*12/05/2018*	*Michelle Page/ mlp7799@uncw.edu*	*Initial Version*

Appendix B: Acronyms

Acronym	Literal Translation
UG	*User Guide*
CSU	*Campus Space Utilization*
OIR	*Office of Institutional Research and Planning*
SPM	*Space Planning Management*
SDM	*Student Data Mart*
UNCW	*University of North Carolina Wilmington*
DL	*DeLoach Hall*
GA	*General Administration*
MS	*Masters of Science*