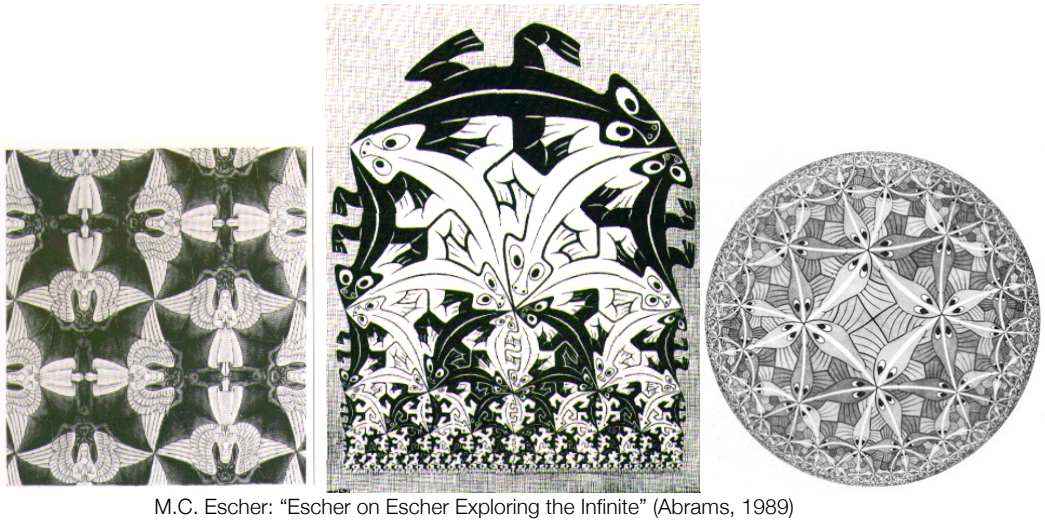
UNIVERSITY OF MIAMI
SCHOOL of
ARCHITECTURE

| | |
|---|---|
| course | **MAKING WITHOUT BOUNDARIES: Mathematical Art** |
| code | *ARC 585, 685* |
| academic calendar | 2016-2017 |
| semester | Fall 2016 |
| credits | 3 |
| classroom | ARCHITECTURE 48-330 |
| class hours | FRIDAY 1:30PM – 4:00PM |
| profesor/s | JUHONG PARK PH.D. |
| professor email | j.park2@miami.edu |
| office hours | by appointment |
| NAAB criteria | primary<br>A2 DESIGN THINKING SKILLS<br>A3 INVESTIGATION SKILLS<br><br>secondary<br>C1 RESEARCH<br>A5 ORDERING SYSTEMS |



M.C. Escher: “Escher on Escher Exploring the Infinite” (Abrams, 1989)

# Making without Boundaries
## *Mathematical Art.*

### *course background*

What is design? What is the design process? Despite more than forty years of design studies, design seems still to be an obscure process. There is no consensus on what design is, and what the design process is. It is hardly possible to describe how architects develop their creative designs. One widely held view of design is Simon's (1973) definition of design as an "illstructured problem," or Churchman's (1967) "wicked problem," because of its ambiguous goals and incomplete information (Voss and Post, 1988). The solutions to this ill-structured problem in design are still as various as design definitions are. Rittel and Webber (1973) described design as a "problem-defining process" in which designers located the problem among "complex causal networks." Parnas (1986) described a design process as a "long sequence of design decisions, with no clear statements of why [the designers] do things the way they do." They explained the intractable nature of the design process as identifying ambiguous boundaries and exploring endless "causal chains" in the solution space. Rittel (1972) illustrated the use of causal patterns in solving wicked problems, such as consequential, non-deterministic, relational, and recursive causality and concludes that naïve scientific approaches (rationality) might not be able to solve wicked problems because of these complex causalities. This workshop revisits Rittel and Webber's (1973) description of the characteristics of wicked problems from the perspective of complex causal patterns.

### *course description*

This digital design and fabrication elective introduces to the programming design and the art of software development. Students will practice how to think like architects / designers with computational thinking such as modularization, abstraction, algorithms and encapsulation. Throughout this course, students will learn how to integrate their own design thinking such as "problem setting" or "problem reframing" with procedural, object-oriented and eXtreme programming paradigms. Daily sketching and diagramming exercises will enhance learners own "figuring-out" process of using programming for empowering their design cognition. The purpose of this exercise is training students how to transform their design ideas into programming structures through segmented sketching and diagramming practices. This workshop, accordingly, will provide a foundation of architectural way of using computational thinking, and work as a prelude to high-level programming. This course will collaborate with the furniture making course offered by Prof. Austin Matheson. Students freely can take only this course or both electives for their furniture making projects. Main tools include Rhino-Python, 3D printing, and CNC cutting.

### *course objectives*

1. Students will acquire fundamental knowledge in computational design and digital fabrication
2. Students will acquire knowledge of algorithmic and systemic thinking
3. Students will be asked to produce fully functional software that generates functional objects.
4. Students will be introduced to a variety of computational thinking such as abstraction, modularization, incremental iteration, and reflection-in-action.

### *announcements, tutorials, and assignments on the Class Blog.*

Students are responsible to follow and update by frequently visiting the course website. All students' assignments, reading materials and documents will be uploaded on the class blog and be open to the public. All course materials will be distributed electronically (no printed materials). Students are responsible for downloading course materials that are accessible during the uploaded week and the link will be deleted after at the end of each week.

Course blog: all materials will be distributed electronically through this blog.
https://mathematicalartfall2016.wordpress.com

## *work load*

This course is highly intensive in terms of daily sketching/coding assignments and students will get daily feedbacks on their codes. As Aberson, Sussman and Sussman (1996) suggested students will work on how to collect fragmented ideas (expression) and to combine those small modules (combination) to develop into a complex idea (abstraction).

A daily assignment is drawing initial sketches, analytical diagrams, Unified Modeling Language (UML) and working codes for a given or self-motivated partial or full function called “stub code.” Suggested function may have less than twelve lines of code and the assignment may complete within thirty minutes. Minimum daily requirement is submitting one function with a couple of pages of sketches. Consistency of submission is the most critical factor in learning programming as it does in learning a foreign language.

Three projects presentation will serve as a temporary target in developing program. Students may bring their own past or current projects with which students will transform their partial or full design concepts into automated - computational process. Those students who do not have any project, a small house (500 ft2) design project will be provided. The project site is located near the Westgate and the Tang hall. The site has very interesting urban and suburban characteristics.

This subject only cares about how each student’s programming learning progress over the semester. Students need not to bring fancy ideas or projects. It is not recommended to use any external source codes either sample programs. Rather, this subject cares how much students’ fluency and competency in using programming for their architectural projects are improved compared to themselves on week one. After this workshop, each student may have at least 63 sketches and functions. You will share about 600 codes together. The combinations of your codes and other colleagues’ codes are limitless.

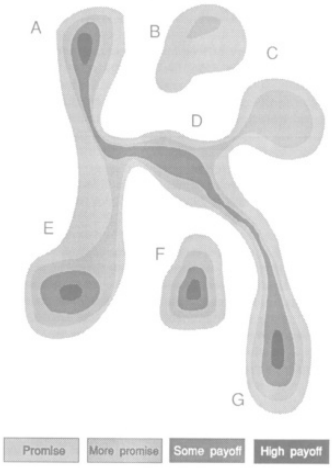



Figure 2. Klondike Space (Perkins, 1996)

## *course brief*

How do architects’ minds move while they are designing? How do new perceptions evolve during design processes? Perkins (1996) uses “Klondike Space” as a metaphor to answer how minds move. The Klondike in the Yukon Territory, Alaska, is where people found gold and this brought the gold rush in the 1850s. Although some people found fortunes, many failed to discover any gold. Perkins compares the difficult process of finding creativity with the process of finding gold in the Klondike. He (1996) understands creativity as a “search through a possibility space (problem space)” and evolution as “operations in a Klondike space.” Perkins cites artificial evolution, which simulates nature’s evolutionary process in a virtual world (inside computers), to illustrate how minds can be moving in Klondike space. By using computer programming, computer scientists build a program that generates random variations, algorithmically selects the best fits among the mutations,

and repeats generation and selection processes. He understands this artificial evolution as one possible underlying mechanism of creativity.

Artificial life (alife) is a study that explores living systems by simulating their behaviors, phenomena, and evolutionary processes in artificial environments using computer software (programming) and hardware (robotics). One of the early studies in alife goes back to British mathematician Conway's "Game of Life" in the 1970s, which is a computational model of self-replicating machines. The Game of Life consists of a two-dimensional grid of cells and three local rules that control whether each cell is alive or dead. At every calculation time, each cell decides its state based on the number of living or dead neighboring cells. This game stimulates other development of decentralized and self-organized models, such as the cellular automata research.

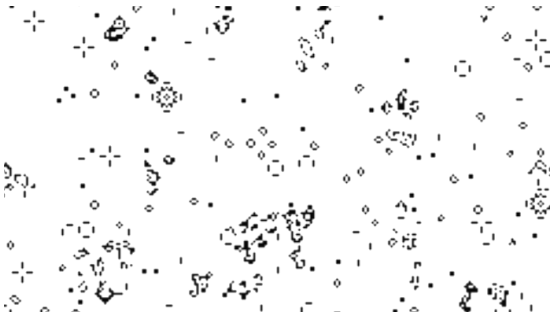


Figure 3. Conway's Game of Life (Cox, 2011)

Due to artificial life's process of evolutionary patterns and illustration of self-organizing mechanisms, alife shows the underlying mechanism of biological creativity by analogy, such as generation of variations, autonomous adaptation, and open-ended evolution. Within the framework of modeling alife that is called "life-as-it-might-be," researchers explore the simplest form and underlying rules of life by developing and simulating a computational model of the living system. The program structures and simulation results provide an insight into how creativity happens.

In this workshop, students will use four computational models of artificial life - recursion, Koch's curve (Lindenmayer system), cellular automata, and flocking algorithms - to learn about complex causal patterns, such as recursive, consequential, decentralized, and distributed causalities.

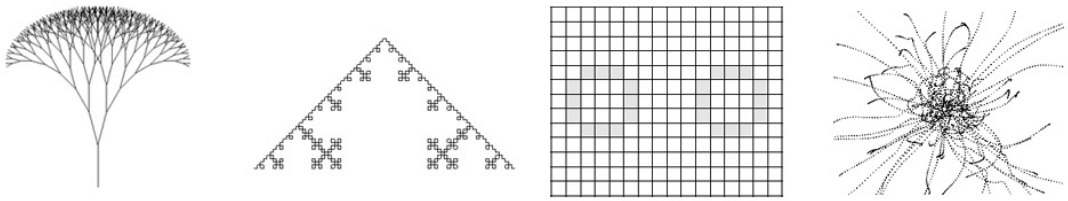


Figure 4. Artificial Life: recursion, Koch's curve, cellular automata and flocking

By using the four models of artificial life, students will design and fabricate fully functional furniture. The workshop consists of four successive modules. In each module, students redo the same design project. However, they learn and use a different computational model of artificial life and causal patterns. During the repeated modules, they will learn about computer programming and software design, and will have a deep understanding of design and design processes.

## *Reading Materials:*

Several articles and reading materials will be uploaded to the course website or distributed electronically. However, there is a supplementary list of references

### *for learning and design process:*

Perkins, D. N. (1994). Creativity: Beyond the Darwinian paradigm. In M. A. Boden (Ed.), Dimensions of creativity (pp. 119-142). Cambridge, MA: MIT Press
Perkins, D. N. (1995). Insight in minds and genes. In R. J. Sternberg & J. E. Davidson (Eds.), The nature of insight (pp. 495-534). Cambridge, MA: MIT Press
Perkins, D.N., & Grotzer, T.A. (2005). Dimensions of causal understanding: The role of complex causal models in students' understanding of science. Studies in Science Education, 41, 117-166.
Parnas, D. L., & Clements, P. C. (1986). A rational design process: How and why to fake it. IEEE Trans. Softw. Eng., 12(2), 251
Graham, P. (2010). Hackers & Painters: Big Ideas from the Computer Age (1st ed.). O'Reilly Media.
Rittel, H. W. J. & Webber, M. M. (1973). Dilemmas in a general theory of planning. Policy Sciences, 4(2), 155-169.
Schon, D. A. (1995). The Reflective Practitioner: How Professionals Think in Action. Ashgate Publishing.
Schön, D. A. & Wiggins, G. (1992). Kinds of Seeing in Designing. Creativity and Innovation Management, 1(2), 68-74.

### *for programming language tutorial:*

Downey, A., Elkner, J., & Meyers, C. (2009). Learning with PYTHON: How to Think Like a Computer Scientist (1st ed.). CreateSpace.
Perry, G. (1994). Absolute Beginner's Guide to C (2nd ed.). Sams.
Farrell, J. (2010). Programming Logic and Design: Comprehensive (6th ed.). Course Technology.
Venit, S. & Drake, E. (2010). Prelude to Programming: Concepts and Design (5th Edition) Addison Wesley.

### *for software design and programming:*

Bentley, J. (1999). Programming Pearls (2nd ed.). Addison-Wesley Professional.
Martin, R. C. (2003). UML for JavaTM Programmers. Prentice Hall.
Glass, R. L. (2002). Facts and Fallacies of Software Engineering (1st ed.). Addison Wesley Professional.
Beck, K. & Andres, C. (2004). Extreme Programming Explained: Embrace Change (2nd ed.). Addison-Wesley Professional.
McConnell, S. (1997). Software Project Survival Guide (1st ed.). Microsoft Press.

## evaluation

### *Daily Assignments: 60%*

At every class time there will be quick class assignments that each student should submit on the class blog by the end of the day (uploaded to class blog which will have time marks). These assignments are mainly exercising demonstrated tutorials covered during class time. These assignments should be finished within one hour, following recorded class tutorials or could be finished during each class time. The first week is the most important week in learning the foundation of computational design thinking. Accordingly, daily assignments are weighted differently. Here are the proportions of weekly weights.

| | |
|---|---|
| Week 1 ~ 6 | 30% |
| Week 7 ~ 11 | 20% |
| Week 12 ~ 15 | 10% |

### *Design projects and final exhibition: 40%*

Weekly Projects: Five 10" x 10" printed images (please sign your name and date with a pencil)
Final Project: One 300 dpi image (36" x 36") for a final project
One 300 dpi image (36" x 36") that includes 50 daily images.
Final Project Exhibition/Presentation: Fifty 10" x 10" daily projects + Final Project

### *Attendance*

Every student is expected to attend every class session and stay in a classroom during the assigned class time. This course however accepts any students' missing due to sicknesses, illnesses, family emergencies, conferences, or field trips. To waive any missing classes, students are required to submit hard copies of letters from relevant parties.

## *schedule (subject to change)*

### *Module 1: Procedural Programming*

W01. Course Overview Fundamentals of Programming
W02. Programming Structure,
W03. Recursion
W04. Module 1 Review

### *Module 2: Object-Oriented Programming*

W04. OOD Introduction
W05. Lindenmayer System.
W06. Koch's Curve
W07. Spring Recess
W08. Module 2 Review

### *Module 3: Extreme Programming*

W09. Fall Recess (no class)
W10. OOD extension: Inheritance and Interface
W11. Cellular Automata + The Game of Life
W12. Fractals
W13. Flocking Algorithm

### *Final Review*

W14. Thanksgiving (no class)
W15. Final Review Prep
W16. Final Exhibition/Review

**UNIVERSITY OF MIAMI ACADEMIC CALENDAR**

**FALL 2016**

***Subject to Change***

**69 Class Days Per Semester**

| | | |
|---|---|---|
| Aug 8 | Mon | Deadline for Readmission |
| Aug 8 | Mon | Prestigious Awards and Fellowships Due in Honors Program & Office of Academic Enhancement. For specific deadline dates on the various awards see www.miami.edu/oae. |
| Aug 16 | Tues | Housing Available for New Students |
| Aug 16 | Tues | International Student Orientation |
| Aug 17- 21 | Wed-Sun | Fall 'Cane Kickoff |
| Aug 18 | Thurs | Housing Available for Continuing Students |
| Aug 22 | Mon | CLASSES BEGIN |
| Aug 22 | Mon | Late Registration Fees in Effect |
| Aug 31 | Wed | Last Day for Registration and to Add a Course |
| Sept 5 | Mon | HOLIDAY (LABOR DAY) |
| Sept 7 | Wed | Last Day to Drop a Course Without a "W" |
| Sept 7 | Wed | Deadline to apply for Inactive Staus |
| Sept 7 | Wed | Deadline to apply for Non-UM programs |
| Sept 7 | Wed | Last Day to Make a Change in Credit-Only Designation |
| Sept 14 | Wed | Application for Graduation Opens |
| Sep 26 | Mon | Midterm Reporting begins |
| Oct 14 | Fri | Last Day to Apply for Graduation for Fall |
| Oct 20-23 | Thurs-Sun | FALL RECESS |
| Oct 24 | Mon | Last Day to Drop a Course |
| Oct 24 | Mon | Registration Appointments Available on CaneLink |
| Nov 4 | Fri | Graduate Students: Last Day to Defend Dissertation/Thesis for Fall 2016 Graduation |
| Nov 7 | Mon | Registration for Spring 2017* (Begins) |
| Nov 19 - Nov 27 | Sat-Sun | THANKSGIVING RECESS |
| Dec 6 | Tues | CLASSES END (11:00 PM) |
| Dec 6 | Tues | Grade Roster available to Faculty |
| Dec 7 | Wed | Reading Day |
| Dec 8-14 | Thurs-Wed | FINAL EXAMS |
| Dec 14 | Wed | Graduate School Deadline for Completion of Dissertation/Thesis |
| Dec 14 | Wed | SEMESTER ENDS (11:00 PM) |
| Dec 15 | Thurs | FALL COMMENCEMENT EXERCISES - All Degrees |
| Dec 15 | Thurs | Housing Closes at NOON for Non-Commencement Participants |
| Dec 16 | Fri | Housing Closes at NOON for Commencement Participants |
| Dec 19 | Mon | Final Grades Released by Faculty in CaneLink by Noon |
| Dec 21 | Wed | Final Grades Available to Students in CaneLink |

**As Scheduled By Appointment*

Updated July 21, 2016

**Most up-to-date calendars available at: http://www.miami.edu/registrar**

## student work

> All academic work is the property of the University. At the conclusion of the semester students should prepare and submit digital files on a disk or flash drive to their respective faculty. Any original work identified by faculty as archival or as exhibits for accreditation will be collected by faculty for the duration of the accreditation visit.

IMAGEBANK STUDENT WORK COLLECTION FILE FORMATS
>.jpg or .jpeg Joint Photographic Expert Group.300dpi, (ideally) 400dpi Minimum target size: 24' by 36'
>.pdf Portable Document Format images. images 400dpi, lines and text 1200dpi target size: 24' by 36'
SCANNING .jpeg and .tiff
Minimum resolution: (at least) 300dpi, (ideally) 400dpi -- dots per inch Minimum target size: 24' by 36'
Note: When scanning plans or black/white line drawings choose Text option on the scanner settings dialog box. If lines do not appear complete then use CURVES & adjust the THRESHOLD & AUTO LEVELS in Adobe Photoshop.
> The University may retain selected student work and may place it in the architecture archives for exhibition, publication,
or other use as the University deems appropriate.
>Each student in architecture is encouraged to maintain a personal portfolio of the work undertaken throughout their academic program.
> At the end of the semester students should retrieve all of their belongings from the desk, locker, and walls. After the final submission deadline every item left behind will be considered useless and may be thrown away without further notice.

## grading

This information is obtained through the University of Miami Academic Bulletin. Student responsibility is to check if there is a new updated version that could modify the one exposed here.
Students should always refer to http://bulletin.miami.edu/ for an updated version.

### *UNDERGRADUATE ARCHITECTURE STUDENTS*

| | |
|---|---|
| A | Excellent attainment |
| B | Good attainment |
| C | Fair attainment |
| D | Poor attainment (earns credit hour but may not fulfill requirement for a major) |
| F | Failure |
| W | Course dropped on or before the last day for withdrawing from classes as published in the official calendar of the University. Credit hour can be earned only by successful repetition of the course. |
| I | Incomplete work in passing status with the instructor's permission to complete the course. An "I" will be assigned only if the instructor is satisfied that there are reasonable non-academic grounds for the student's incomplete work. An "I" is not intended to be assigned in order to permit a student to repeat a course without registration or to permit a student to do additional work in order to improve upon grades earned during the semester. The student who receives an "I" must complete the course with a passing grade within the time frame specified by the professor of the course but not longer than the end of one calendar year, or prior to graduation, whichever occurs first. An Academic Dean may approve an extension initiated by the course instructor. An "I" not completed prior to the student's graduation shall be changed to an "IE" or "IF" by action of the student's Academic Dean. |
| IP | Denotes in progress grade assigned upon satisfactory completion of the first semester of a two-semester sequence, with the final grade for both courses to be submitted at the end of the second semester of the sequence. Please note that all "IP"s must be converted to a letter grade or "IF" at graduation. "IP" will also be converted to "IF" upon any departure from the University for a period in excess of one year. |
| IF | Symbol indicating that an "I" grade was not appropriately completed.4 The symbol "IF" is equivalent to an "F" when computing a student's average. |
| CR | Grade signifying that credit only is awarded based on a "C" average or better. |
| NC | Grade signifying that no credit hour is awarded based on a course average below a grade of "C". |
| NG | Symbol assigned by the Office of the Registrar indicating that the instructor has not reported the student's grade. For a student to receive credit hour for the course, the instructor must report a passing grade prior to the student's graduation, or by the end of one regular academic semester, whichever comes first. An Academic Dean may approve an extension initiated by the course instructor. An "NG" not replaced by a passing grade, or by a "W", prior to the student's graduation shall be |

| | |
|---|---|
| | changed to an "F" by action of the student's Academic Dean.5 |

## *grade point average*

The grade point average is used to determine:
> class rank
> graduation and university honor eligibility
> good standing, probation, and dismissal status
> scholarship eligibility

Your official grade point average is based only on the work you have completed at the University of Miami. The only exception to this policy is for determining whether a student qualifies for university honors established by the minimum grade point requirement at the time of graduation. For graduation purposes, cumulative grade point average is defined as either the average of all grades earned at the University of Miami or the combined average of all graded work taken at the University of Miami and elsewhere whether or not the transfer work is accepted toward a degree at the University of Miami, whichever is lower.

Quality points per credit hour are awarded as follows:

| | |
|---|---|
| A+ | 4.00 |
| A | 4.00 |
| A- | 3.70 |
| B+ | 3.30 |
| B | 3.00 |
| B- | 2.70 |
| C+ | 2.30 |
| C | 2.00 |
| C- | 1.70 |
| D+ | 1.30 |
| D | 1.00 |
| E | 0.00 (prior to fall 1995) |
| IE | 0.00 |
| F | 0.00 (effective fall 1995) |
| iF | 0.00 |

>Courses marked with an "IE" or "IF" count as credit hour attempted but are not counted in credit hours earned and do not carry quality points.
> Credit hours marked CR are counted as credit hours earned but are not counted in credit hours attempted and do not carry quality points.
> Courses marked with the symbols I, IP, W, NC, and NG do not carry credit hours attempted, credit hours earned, or quality points.
> The grade point average is determined by dividing the total quality points earned by the total credit hours attempted.
>Military service credit hour, some foreign university credit hour, correspondence course credit hour, credit by examination, etc., are not awarded quality points and do not enter the computation of the grade point average.

## *GRADUATE ARCHITECTURE STUDENTS*
### *Grade Interpretations*

| | |
|---|---|
| A | Excellent accomplishment. |
| B | Good accomplishment. |
| C | Fair, but below that expected of graduate students (C- is the lowest passing grade. Some programs may require higher standards.). |
| S | Symbol used for acceptable (U-unacceptable) thesis, dissertation, practicum and internship credit hour. It may be used for regular courses under special circumstances with the prior approval of the instructor, department chairman, and the Dean of the Graduate School. The Graduate School considers a grade of "S" to indicate a minimum of a 3.0 GPA in a graduate course if a student has taken no prior coursework on the graduate level. A grade of "S" reflects that a student is in good |

| | |
|---|---|
| | academic standing. |
| D | Poor (not acceptable for credit hour toward the advanced degree). |
| F | Failure |
| W | Course dropped prior to the last day for withdrawing from classes as published in the official calendar of the University. Courses dropped after last date must have approval of Dean of Graduate School. Credit hour can be earned only by successful repetition of the course. |
| I | Incomplete work in passing status with the instructor's permission to complete the course. (Not to be used for thesis or dissertation credit hours). Student may request an incomplete from the professor if: they have completed at least 75% of the course and have a C or better in the course at the time of the request. The "I" should be changed to a letter grade within one (1) calendar year after it is given, unless the Academic Dean of the student's primary school or college and the Dean of the Graduate School approve the delay. If the "I" is not changed within one year, credit hour can be earned only by successful repetition of the course. (Note: Fellowships and financial aid may be withdrawn if there is an excess accumulation of "I"s on a student's transcript.). |
| IP | Denotes in progress grade given by instructor for any course (600, 700, or 800 level) in which a student has made expected or clearly satisfactory progress during the term, but has yet fully to complete requirements for the course. "IP" is to be given for 800-level internships, research, thesis and dissertation courses that have not been completed. Upon satisfaction of all Graduate School requirements, the Assistant Director, Programs of the Graduate School will issue final credit hour for all master's thesis and doctoral dissertation courses (e.g., 810, 820, 830, 835, 840 and 850). Zero-credit hour courses (e.g., 820 and 850) will be changed to "S." Please note that all "IP"s must be converted to "S", letter grade, or "I" at graduation. "IP" will also be converted to "I" upon any departure from the University for a period in excess of one year. |
| NP | Symbol assigned by Enrollment Services indicating that the instructor has not yet reported the student's grade. For a student to receive credit hour for the course, the instructor must report a passing grade prior to the student's graduation. (Faculty Senate Legislation #85005(B)) |

Quality points are awarded as follows: The quality point average is then determined by dividing the total of quality points earned by the total of credit hours attempted. The symbols "S", "W", and "I" are not counted as credit hour attempted.

| | |
|---|---|
| A+ | 4.00 |
| A | 4.00 |
| A- | 3.70 |
| B+ | 3.30 |
| B | 3.00 |
| B- | 2.70 |
| C+ | 2.30 |
| C | 2.00 |
| C- | 1.70 |
| D+ | 0.00 |
| D | 0.00 |
| F | 0.00 |

## NAAB student performance criteria (SPC)

The accredited degree program must demonstrate that each graduate possesses the knowledge and skills defined by the criteria below. The knowledge and skills defined here represent those required to prepare graduates for the path to internship, examination, and licensure and to engage in related fields. The program must provide student work as evidence that its graduates have satisfied each criterion.
The criteria encompass two levels of accomplishment:
> UNDERSTANDING: The capacity to classify, compare, summarize, explain and/or interpret information.
> ABILITY: Proficiency in using specific information to accomplish a task, correctly selecting the appropriate information, and accurately applying it to the solution of a specific problem, while also distinguishing the effects of its implementation.
The SPC are organized into realms to more easily understand the relationships between each criterion.

This course emphasize the following NAAB Student Performance Criteria:

*primary*

## REALM A
Critical Thinking and Representation

### A2 Design Thinking Skills
Ability to raise clear and precise questions, use abstract ideas to interpret information, consider diverse points of view, reach well-reasoned conclusions, and test alternative outcomes against relevant criteria and standards.

### A3 Investigative Skills
Ability to gather, assess, record, and comparatively evaluate relevant information and performance in order to support conclusions related to a specific project or assignment.

*secondary*

## REALM A
Critical Thinking and Representation

### A5 Ordering Systems
Ability to apply the fundamentals of both natural and formal ordering systems and the capacity of each to inform two- and three-dimensional design.

## REALM C
Integrated Architectural Solutions

### C1 Research
Understanding of the theoretical and applied research methodologies and practices used during the design process.

Table of NAAB Student Performance Criteria (SPC):

| **REALM A**<br>**Critical Thinking and Representation** | **REALM B**<br>**Building Practices, Technical Skills, and Knowledge** | **REALM C**<br>**Integrated Architectural Solutions** | **REALM D**<br>**Professional Practice** |
|---|---|---|---|
| Graduates from NAAB-accredited programs must be able to build abstract relationships and understand the impact of ideas based on the study and analysis of multiple theoretical, social, political, economic, cultural, and environmental contexts. Graduates must also be able to use a diverse range of skills to think about and convey architectural ideas, including writing, investigating, speaking, drawing, and modeling. Student aspirations for this realm include:<br>> Being broadly educated<br>> Valuing lifelong inquisitiveness<br>> Communicating graphically in a range of media<br>> Assessing evidence<br>> Comprehending people, place, and context<br>>Recognize disparate needs of client, community, and society.<br>**A1 Professional Communication Skills**<br>Ability to write and speak effectively and use representational media appropriate for both within the profession and with the general public.<br>**A2 Design Thinking Skills**<br>Ability to raise clear and precise questions, use abstract ideas to interpret information, consider diverse points of view, reach well-reasoned conclusions, and test alternative outcomes against relevant criteria and standards.<br>**A3 Investigative Skills**<br>Ability to gather, assess, record, and comparatively | Graduates from NAABaccredited programs must be able to comprehend the technical aspects of design, systems, and materials and be able to apply that comprehension to architectural solutions. In addition, the impact of such decisions on the environment must be well considered.<br>Student learning aspirations for this realm include:<br>> Creating building designs with well-integrated systems.<br>> Comprehending constructability<br>> Integrating the principles of environmental stewardship.<br>> Conveying technical information accurately.<br>**B1 Pre-Design**<br>Ability to prepare a comprehensive program for an architectural project that includes an assessment of client and user needs; an inventory of spaces and their requirements; an analysis of site conditions (including existing buildings); a review of the relevant building codes and standards, including relevant sustainability requirements, and an assessment of their implications for the project; and a definition of site selection and design assessment criteria.<br>**B2 Site Design**<br>Ability to respond to site characteristics, including urban context and developmental patterning, historical fabric, soil, topography, ecology, climate, and building orientation, in the development of a project design.<br>**B3 Codes and Regulations**<br>Ability to design sites, facilities, and systems that are responsive to relevant codes and regulations, and include the principles of life-safety and accessibility standards.<br>B4 Technical Documentation<br>Ability to make technically clear drawings, prepare outline | Graduates from NAAB-accredited programs must be able to demonstrate that they have the ability to synthesize a wide range of variables into an integrated design solution.<br>Student learning aspirations for this realm include:<br>> Comprehending the importance of research pursuits to inform the design process.<br>> Evaluating options and reconciling the implications of design decisions across systems and scales.<br>> Synthesizing variables from diverse and complex systems into an integrated architectural solution.<br>> Responding to environmental stewardship goals across multiple systems for an integrated solution."<br>**C1 Research**<br>Understanding of the theoretical and applied research methodologies and | Graduates from NAAB-accredited programs must understand business principles for the practice of architecture, including management, advocacy, and the need to act legally, ethically, and critically for the good of the client, society, and the public. Student learning aspirations for this realm include: > Comprehending the business of architecture and construction.<br>> Discerning the valuable roles and key players in related disciplines.<br>> Understanding a professional code of ethics, as well as legal and professional responsibilities.<br>**D1 Stakeholder Roles in Architecture**<br>Understanding of the relationships among key stakeholders in the design process—client, contractor, architect, user groups, local community—and the architect's role to reconcile stakeholder needs.<br>**D2 Project Management**<br>Understanding of the methods for selecting consultants and assembling teams; identifying work plans, project schedules, and time |

evaluate relevant information and performance in order to support conclusions related to a specific project or assignment.

**A4 Architectural Design Skills**

Ability to effectively use basic formal, organizational and environmental principles and the capacity of each to inform two- and three-dimensional design.

**A5 Ordering Systems**

Ability to apply the fundamentals of both natural and formal ordering systems and the capacity of of each to inform two- and threedimensional design.

**A6 Use of Precedents**

Ability to examine and comprehend the fundamental principles present in relevant precedents and to make informed choices about the incorporation of such principles into architecture and urban design projects.

**A7 History and Global Culture**

Understanding of the parallel and divergent histories of architecture and the cultural norms of a variety of indigenous, vernacular, local, and regional settings in terms of their political, economic, social, ecological, and technological factors.

**A8 Cultural Diversity and Social Equity**

Understanding of the diverse needs, values, behavioral norms, physical abilities, and social and spatial patterns that characterize different cultures and individuals and the responsibility of the architect to ensure equity of access to sites, buildings, and structures.

specifications, and construct models illustrating and identifying the assembly of materials, systems, and components appropriate for a building design.

**B5 Structural Systems**

Ability to demonstrate the basic principles of structural systems and their ability to withstand gravitational, seismic, and lateral forces, as well as the selection and application of the appropriate structural system.

**B6 Environmental Systems**

Ability to demonstrate the principles of environmental systems' design, how design criteria can vary by geographic region, and the tools used for performance assessment. This demonstration must include active and passive heating and cooling, solar geometry, daylighting, natural ventilation, indoor air quality, solar systems, lighting systems, and acoustics.

**B7 Building Envelope Systems and Assemblies**

Understanding of the basic principles involved in the appropriate selection and application of building envelope systems relative to fundamental performance, aesthetics, moisture transfer, durability, and energy and material resources.

B8 Building Materials and Assemblies

Understanding of the basic principles used in the appropriate selection of interior and exterior construction materials, finishes, products, components, and assemblies based on their inherent performance, including environmental impact and reuse.

**B9 Building Service Systems**

Understanding of the basic principles and appropriate application and performance of building service systems, including lighting, mechanical, plumbing, electrical, communication, vertical transportation, security, and fire protection systems.

**B10 Financial Considerations**

Understanding of the fundamentals of building costs, which must include project financing methods and feasibility, construction cost estimating, construction scheduling, operational costs, and life-cycle costs.

practices used during the design process.

**C2 Integrated Evaluations & Decision-Making Design Process**

Ability to demonstrate the skills associated with making integrated decisions across multiple systems and variables in the completion of a design project. This demonstration includes problem identification, setting evaluative criteria, analyzing solutions, and predicting the effectiveness of implementation.

**C3 Integrative Design**

Ability to make design decisions within a complex architectural project while demonstrating broad integration and consideration of environmental stewardship, technical documentation, accessibility, site conditions, life safety, environmental systems, structural systems, and building envelope systems and assemblies.

requirements; and recommending project delivery methods.

**D3 Business Practices**

Understanding of the basic principles of a firm's

business practices, including financial management and business planning, marketing, organization, and entrepreneurship.

**D4 Legal Responsibilities**

Understanding of the architect's responsibility to

the public and the client as determined by regulations and legal considerations involving the practice of architecture and professional service contracts.

**D5 Professional Conduct**

Understanding of the ethical issues involved in the exercise of professional judgment in architectural design and practice and understanding the role of the NCARB Rules of Conduct and the AIA

## final due date

Due dates are set by the Course Instructor in the schedule and evaluation sections of this outline. All term work must be submitted on or before the date stipulated by the Instructor.

Students who for reasons beyond their control are unable to submit an assignment by its deadline must obtain approval from their Instructor for an extension to the deadline.

All student work including assignments and final projects must uploaded to the server in PDF format (except for video projects) prior to the end of term.

## class attendance and absences

Regular and punctual class attendance is mandatory for all architecture courses; three unexcused absences constitutes grounds for dismissal from the course and/or a failing grade. Students are required to be present for an entire class, therefore, students arriving late or departing early from class will be considered absent. Excused absences require written notification and are granted by the instructor.

It is each student's responsibility to know and understand the instructor's policies. It is also the student's responsibility to give the instructor notice one week prior to any anticipated absence and to contact the instructor within one week after any unanticipated absence.

All students are responsible for material covered during their absence. However, the instructor must allow each student who is absent for a University approved reason either the opportunity to make up, or to be excused from, work missed, without any reduction in the student's final course grade as a direct result of such absence.

Other than absences for a University-approved reason, the instructor determines whether or not an absence is for an acceptable reason and whether or not students shall have the opportunity to make up missed work. If the instructor does not recognize the reason as acceptable, the student may appeal to the chair of the department.

UNIVERSITY-APPROVED REASONS FOR ABSENCES
1. Participation in an activity approved by the Academic Deans Policy Council, such as musical and debate activity, R.O.T.C. function, or varsity athletic trip; participation in a special academic activity such as a field trip or other special event connected with academic coursework. Verification of a student's participation shall be issued by the sponsor when authorized by the Office of the Executive Vice President and Provost.
2. Observance of a religious holy day as described in the Religious Holy Day Policy, below:

RELIGIOUS HOLY DAY POLICY
The University of Miami, although a secular institution, is determined to accommodate those students who wish to observe religious holy days. It seeks to reflect its awareness of and sensitivity to religious holy days whenever possible when scheduling University activities. The following provisions are meant to apply equitably to all religious groups and to provide opportunities to all to meet their religious obligations.
1. Except as specifically provided to the contrary, this policy is binding on all students in undergraduate programs. Schools offering graduate or professional programs, including undergraduate professional programs, are strongly encouraged to adhere to these policies to the maximum extent practicable.
2. Any student absent from class in observance of a religious holy day shall not be penalized in any way for an examination or assignment missed during the period of absence. Absence in observance of a religious holy day does not relieve students from responsibility for any part of the course work required during the period of absence. Students who are absent on days of examinations or class assignments shall be offered a reasonable opportunity to make up the work without penalty, if the student previously arranged to be absent. Nothing in this policy shall preclude faculty members from limiting the number of student absences to a reasonable number of absences for any reason. The faculty member has discretion to determine how the make-up obligation will be fulfilled. A faculty member who penalizes a student contrary to these provisions may have committed unprofessional conduct, and thus may be subject to a complaint to the Committee on Professional Conduct under the provisions of Section B4.9 of the Faculty Manual.
3. It is the student's obligation to provide faculty members with notice of the dates they will be absent due to observance of religious holy days, preferably before the beginning of classes but no later than the end of the first three class days. For religious holy days that fall within the first three class days, students must provide faculty members with notice no later than two class days before the absence. Missing a class due to travel plans associated with a particular religious holy day does not constitute an excused absence. Absences due to observance of religious holy days that are not pre-arranged with the relevant faculty member within the first three class days may be considered unexcused, and the faculty member may therefore prevent the student from making up examinations or assignments missed during the period of absence.
4. Faculty members are encouraged to anticipate days when a substantial number of students will be absent for observance of religious holy days and should avoid scheduling examinations and assignment deadlines on those days. Faculty members are expected to reasonably assist students in obtaining class information the student missed during the period of absence in observance of a religious holy day. In that regard, faculty members are urged to allow taping or recording of the class session, with the reproduction limited to the student's personal use, when a student misses a class due to observance of a religious holy day. To assist in identifying religious observance days, faculty members are encouraged to consult the illustrative list provided in the Interfaith Calendar (http://www.interfaithcalendar.org). Faculty members are urged to remind students of their obligation to inform faculty members within the first three class days of any anticipated absences due to observance of religious holy days and should include that information in the syllabus or course requirements document for that course

## plagiarism and misconduct: honor code

The University's policy on academic misconduct is contained in the University of Miami Honor Code.
These Codes are established for the student body to protect the academic integrity of the University of Miami, to encourage consistent ethical behavior among students, and to foster a climate of fair competition. While a student's commitment to honesty and personal integrity is assumed and expected, these Codes are intended to provide an added measure of assurance that, in fulfilling the University's requirements, the student will never engage in falsification, plagiarism, or other deception regarding the materials he/she presents. Each student is responsible for completing the academic requirements of each course in the manner indicated by the faculty.

The University's policy on academic misconduct for UNDERgraduate students is found on:

https://umshare.miami.edu/web/wda/deanstudents/pdf/undergrad_honorcode.pdf
The University's policy on academic misconduct for graduate students is found on:
https://umshare.miami.edu/web/wda/deanstudents/pdf/GraduateStudentHonorCode.pdf

## english language and writing support

Whether you need help with english language and writing support, students can be assisted through the Writing Center.
The Writing Center at the University of Miami strives to help all members of the university community learn more about writing and become better writers. Writers at all levels can benefit from sharing their writing with someone who is both knowledgeable and trustworthy, someone who is not grading them or evaluating their work. Our professional and friendly staff of faculty and graduate students will work with you in one-to-one consultations on all stages of the writing process: from note-taking and pre-writing to revision strategies and proofreading techniques.
The Writing Center is a teaching environment. We will work to teach you ways to improve your writing, but we will not proofread or edit your papers for you. (We will, however, teach you how to proofread and edit your own papers.) Our focus is more on helping you improve as a writer, rather than fixing the paper you bring in.
The Writing Center is located at: LaGorce House170, 1228 Dickinson Drive