2018 UNLV STEM Summer Camp
2018 UNLV STEM SUMMER CAMP

DAILY SCHEDULE OF CLASSES

*NOTE: Students in Groups A, B & C will rotate each period to next class in the Morning Session and repeat the same process in the Afternoon Session; Instructors will remain in same classroom each period.

GROUP A – ALL MIDDLE SCHOOL STUDENTS IN FALL 2018
GROUP B – ALL 9TH & 10TH GRADE STUDENTS IN FALL 2018
GROUP C – ALL 11TH & 12TH GRADE STUDENTS IN FALL 2018

<table>
<thead>
<tr>
<th>PERIOD</th>
<th>CLASS</th>
<th>TAB</th>
<th>ROOM</th>
<th>STUDENT GROUP</th>
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<tbody>
<tr>
<td>General Assembly</td>
<td>ALL STUDENTS</td>
<td>NONE</td>
<td>First Day – SU 208A</td>
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<tr>
<td>9:00 – 9:50 AM</td>
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<tr>
<td>1</td>
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<td>BEH 222</td>
<td>A*</td>
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<td>DIGITAL DESIGN</td>
<td>DIGITAL</td>
<td>CBC C125</td>
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<td>ENGINEERING DESIGN</td>
<td>SKETCH UP</td>
<td>BEH 213</td>
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<td>LUNCH</td>
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<td>DINING COMMONS</td>
<td>ALL STUDENTS &amp; FACULTY/STAFF</td>
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<td>PYTHON PROGRAMMING</td>
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<td>A.I. &amp; ROBOTICS</td>
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<td>BEH 222</td>
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A Special Thanks to Our Scholarship Sponsors

✓ UNLV Vice President of Student Affairs
✓ UNLV CSUN Student Government
✓ Nevada State Gear Up
✓ UNLV CAEO Gear Up
<table>
<thead>
<tr>
<th>Week</th>
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<td>Expectation Lecture</td>
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UNLV STEM Summer Camp  
Digital Design  
July 9-27, 2018  
Proposed by: Manisha Ghimire (ghimim1@unlv.nevada.edu) & Dr. Venkatesan Muthukumar (venkatesan.muthukumar@unlv.edu)

Course Syllabus
This three-week course is intended to make students familiar with digital design with the help of logic design and hardware programming. It is an introductory level course designed for active participation of students in learning principles behind hardware programming using reconfigurable chips. Students will learn fundamentals of logic design, modeling of design using Verilog Hardware Programming Language, implement design on FPGAs and develop projects on a FPGA development board.

Week 1
1. Introduction to current, voltage and logic.
2. Introduction to ICs and logic gates
3. Logic gates in breadboard I
4. Logic gates in breadboard II
5. Quiz1, Simulation in Quartus.

Week 2
1. Simple circuits with logic gates
2. Introduction to hardware programming, Verilog
3. Introduction to hardware programming, Verilog
4. Simulation using Verilog and Quartus I
5. Quiz2, project idea discussion

Week 3
1. Simulation in Verilog and Quartus II
2. Simulation in Verilog and Quartus III
3. Project building and discussion I
4. Quiz3, Project building and discussion II
5. Project building and discussion III
### Course Schedule:

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<thead>
<tr>
<th>Date</th>
<th>Week day</th>
<th>Course Plan</th>
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<tr>
<td>07/09/2018</td>
<td>Monday</td>
<td>Introduction - Team Formation</td>
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<td>07/10/2018</td>
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<td>Structural Engineering - Introduction to Sketch Up</td>
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<td>Geotechnical Engineering - Exercise 2</td>
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<td>Environmental Engineering - Exercise 6</td>
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<td>Environmental Engineering - Project Selection</td>
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<td>07/27/2018</td>
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STEM Summer Camp  
University of Nevada, Las Vegas

Instructor

Name: Guymon Hall  
Office: TBE-B382, Mo–Th 12–2pm  
Phone: 702-895-4852  
Email: guymon.hall@unlv.edu

Course Objectives

After completing this course, you will be able to:

- Create programs in the Python programming language using sequential, selection, and repetition structures
- Utilize object-oriented programming techniques to develop robust programming solutions in the Python programming language
- Solve programming tasks by adapting Python programming language constructs to a specific solution

Textbooks


Schedule of Topics

<table>
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<table>
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<th>Selection, Repetition, &amp; Collections</th>
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<table>
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<tr>
<th>Beyond Python Basics</th>
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<tbody>
<tr>
<td>Module 11</td>
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<td>Module 12</td>
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<td>Module 13</td>
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<td>Module 14</td>
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<th>Final Exam</th>
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July 9, 2018  
**Topic:** The College Talk  
**Activity:** Students will work in small groups to pair salary amounts to corresponding careers. Students will also work in groups to talk through what careers they each might like to have when they grow up.  
**Deliverable:** Students will learn about the financial differences that a student can have based on their level of education.

July 10, 2018  
**Topic:** S.M.A.R.T. Goals  
**Activity:** Students will create their S.M.A.R.T. goal and share it with their peers.  
**Deliverable:** Students will learn what S.M.A.R.T. stands for through an interactive presentation.

July 11, 2018  
**Topic:** Visualizing Your Future  
**Activity:** Students will each receive a piece of cardstock. Students will be able to decorate their cardstock using magazine clips that illustrate what they would like their future to look like.  
**Deliverable:** Students will learn about the importance of planning their future and visualizing what they want their future to look like.

July 12, 2018  
**Topic:** Growth vs. Fixed Mindset  
**Activity:** Students will watch movie clips to determine if the characters in the clip have a growth or a fixed mindset. They will identify each clip and the facilitator will conduct a discussion.  
**Deliverable:** Students will be able to distinguish the difference between a fixed mindset and growth mindset.

July 13, 2018  
**Topic:** Developing Strong Study Skills  
**Activity:** Students will get to use technology to build a schedule in Google Calendar along with other classroom technologies.  
**Deliverable:** Students will be able to learn time management and organizational skills to increase academic outcomes. Technological tools will be demonstrated to show the students ways to manage organization.
July 16, 2018
Topic: Get Good Grades
Activity: Students will practice calculating GPA to see how various grades can affect their overall GPA.
Deliverable: Students will be able to understand how to calculate their GPA and the implications of GPA toward academic achievement, extracurricular activities, and the pursuit of higher education.

July 17, 2018
Topic: College Costs and Financial Aid
Activity: Students will participate in an interactive presentation used to compare multiple colleges tuition costs.
Deliverable: Students will understand how financial aid can impact the costs of college.

July 18, 2018
Topic: Apply to College - Advocating for Your Future
Activity: Students will participate in an interactive presentation to learn the “Top 5 Things” that they should do when they are conducting their college search.
Deliverable: Students will be able to understand the differences of applying to in-state or out of state schools as well as public vs. private.

July 19, 2018
Topic: Career Interests and Pursuits
Activity: Students will use technology to complete a worksheet of questions that will help the students learn more about their career of choice: starting salary, level of education, popularity of position, etc.
Deliverable: Students will be able to identify top interest categories/areas related to careers.

July 20, 2018
Topic: STEM Career Opportunities
Activity: Students will get to ask questions of a guest STEM presenter to learn about the presenter’s experience working in the STEM fields.
Deliverable: Students will be able to identify career opportunities in science, technology, engineering, and math fields.

July 23, 2018
Topic: Getting to College - Know Your Resources
Activity: Students are put into groups of five. In these groups, students will work together to create the resources on the list that they are given. Students will gain points for the resources that they are able to create. The winner is the group that is able to gather the most resources. This activity ends with a debrief to help the students understand why each of the resources is important for a successful college search.
Deliverable: Students will work collaboratively to understand the importance of multiple resources in the college application process.
July 24, 2018
**Topic:** College Portfolio
**Activity:** Students will use technology to compile their own college portfolio including a list of five schools that they would like to apply to, their top three major choices, etc. Students will begin creating a template for a resume.
**Deliverable:** Students will be able to understand the components of a college portfolio.

July 25, 2018
**Topic:** College Timeline
**Activity:** Students will plan out which courses they think they should take throughout high school in order to get to college. Students will plan their high school path based on completing 13 core units plus engaging electives of their choice with the understanding that not all CCSD schools offer the same elective courses.
**Deliverable:** Students will be able to understand the components of a college timeline to utilize throughout middle and high school.

July 26, 2018
**Topic:** College Roadmap
**Activity:** Students will be given the time to create their own college roadmap. Students will be given a template of a road map to follow on their way to success.
**Deliverable:** Students will create their own roadmap to college to utilize throughout middle and high school. These roadmaps will detail the activities, sports, courses, and grades that they would like to have through middle and high school.

July 27, 2018
**Topic:** College Roadmap Presentations
**Activity:** Students will present their roadmap to their peers as well as listen to others.
**Deliverable:** Students will identify how their peers intend to complete the college application process.
July 9, 2018  
**Topic:** S.M.A.R.T. Goals  
**Activity:** Students will identify two educational goals and two personal goals. Students will list steps they need to do to accomplish each goal. Students will identify a short-, intermediate-, and long-term career goal. Students will list steps they need to do to accomplish each goal. Students will share ideas on setting educational goals and how it will help them focus on appropriate coursework and other activities in high school. Facilitator will share experiences in goal setting as well.  
**Deliverable:** Students will be able to utilize the criteria of a S.M.A.R.T. goal to design specific, measurable, attainable, realistic, and timely goals for their future.

July 10, 2018  
**Topic:** Visualizing Your Future  
**Activity:** Students will create a vision board to display how their personal interests, skills, and work values contribute to their educational and personal goals for the future. Students will share ideas on how visualizing their future will help them focus on appropriate coursework and other activities in high school. Facilitator will share experiences regarding the power of visualization as well.  
**Deliverable:** Students will be able to understand the importance of planning their future and visualizing what they want their future to look like.

July 11, 2018  
**Topic:** Growth vs. Fixed Mindset  
**Activity:** Students will identify several things that they are particularly skilled at within academics, extracurricular activities, family and peer relationships, etc. Students will share why they believe they are particularly skilled at these things. Facilitator will highlight the differences between things students were naturally skilled at or things that took extra effort to achieve. Students will practice converting fixed mindset phrases into growth mindset phrases. Facilitator will share the “BRAIN” strategy for cultivating a growth mindset and students will brainstorm/share activities that correspond to each “BRAIN” strategy.  
**Deliverable:** Students will be able to distinguish the difference between a fixed mindset and growth mindset and identify action steps to cultivating a growth mindset both personally and educationally.
July 12, 2018  
Topic: Developing Strong Study Skills  
Activity: Students will identify the number of hours spent on various personal and educational activities. Students will determine their top three time consuming activities. Students will share their results and consider which activities should be prioritized based on their results. Students will brainstorm/share tips for time management. Additionally, students will assess their organizational skills and determine the effectiveness on current academic outcomes. Students will brainstorm/share positive organizational skills/traits and/or habits/traits they would like to integrate into their lives to increase academic outcomes.  
Deliverable: Students will be able to apply time management and organizational skills to increase academic outcomes.

July 13, 2018  
Topic: Understanding Your Transcript and GPA  
Activity: Students will discuss what a GPA is, how a GPA is calculated, and important terminology associated with calculating GPA. Students will practice calculating the semester and cumulative GPA of various hypothetical students and determine the effects of taking Honors, Advanced Placement, or International Baccalaureate courses. Students will discuss the implications of GPA within academics, extracurricular activities, and applying to college.  
Deliverable: Students will be able to understand how to calculate their GPA and the implications of GPA toward academic achievement, extracurricular activities, and the pursuit of higher education.

July 16, 2018  
Topic: College Costs  
Activity: Students discuss where they would like to go to college and why they chose that college in particular. Facilitator will highlight the expected cost of attendance for several colleges and explain important terminology associated with understanding college costs. Students will estimate various college expenses for UNLV's cost of attendance. Students will then research the actual estimated costs of college expenses for UNLV's cost of attendance and reflect on their findings. Students will research the cost of attendance for additional colleges of their choosing.  
Deliverable: Students will be able to understand basic college expenses and how it relates to the estimated cost of attendance.

July 17, 2018  
Topic: Financial Aid  
Activity: Facilitator will provide an overview of various financial aid opportunities and explain important terminology associated with different types of financial aid. Students will research various scholarships they can apply for and determine requirements that must be met in order to qualify for these scholarships. Students will share one or more scholarships they found and determine the appropriate steps they must take both educationally and personally throughout high school in order to qualify for these scholarships.
**Deliverable:** Students will be able to understand various financial aid opportunities and how financial aid can assist with the cost of attendance.

**July 18, 2018**
**Topic:** Apply to College - Advocate for Your Future  
**Activity:** Students will be divided into groups. Students will discuss what they believe colleges look for when deciding who to admit to their school. Students will determine and share what they believe are the “top three” most important factors for college admission. Students will work together to play the role of college admissions counselor. Students will review five applications from prospective hypothetical students and determine which applicants will be accepted to their college. Each group will share which students they accepted and what criteria they used to determine admittance. Students will have the opportunity to advocate for certain applicants they believe should be admitted.  
**Deliverable:** Students will be able to understand the college admissions application process and how to advocate for their future.

**July 19, 2018**
**Topic:** Career Interests and Pursuits  
**Activity:** Students will identify three careers that they might be interested in after graduating high school. Students will complete a questionnaire that will help them further determine career interest fields based on their personal interests. Students will research one career of their choice and collect information regarding postsecondary education, salary, job requirements, work environment, etc. Students will organize the information they found and report on their chosen career.  
**Deliverable:** Students will be able to identify top interest categories/areas related to careers.

**July 20, 2018**
**Topic:** STEM Career Opportunities  
**Activity:** UNLV’s GEAR UP STEM coordinator will provide an overview of various career opportunities in science, technology, engineering, and math fields. The GEAR UP STEM coordinator will also share her personal experiences working in the STEM field as a woman of color. The GEAR UP STEM coordinator will lead students through an interactive STEM experience that bridges the connection between classroom learning and content to real-world application.  
**Deliverable:** Students will be able to identify career opportunities in science, technology, engineering, and math fields.

**July 23, 2018**
**Topic:** College Majors and Educational Degrees  
**Activity:** Facilitator will provide an overview of college majors and different types of educational degrees. Students will discuss in detail the differences between a high school diploma, associate’s degree, bachelor’s degree, master’s degree, and a doctoral degree. Students will also identify various careers that fall under each type of educational degree. Students will practice determining the postsecondary option that best fits a number of hypothetical students. Students will discuss why they selected the postsecondary option.
for the student. Students will also create their own student profile indicating their career goal, postsecondary option, and three specific reasons they believe this postsecondary option is the best fit for them.

**Deliverable:** Students will be able to connect college majors and educational degrees with career interests.

**July 24, 2018**
**Topic:** College Portfolio
**Activity:** Facilitator will explain the components of a college portfolio and walk students through what is expected of them as they progress through their senior year and begin applying to colleges. Students will be provided with a binder to begin compiling their own college portfolio. Students will participate in three mini workshops: resume building, personal statement, and letters of recommendation. Students will begin creating a template for their resume.

**Deliverable:** Students will be able to understand the components of a college portfolio.

**July 25, 2018**
**Topic:** College Timeline
**Activity:** Students will discuss the importance of creating a college timeline. Students will be divided into four groups: freshman year, sophomore year, junior year, and senior year. Each group will create a timeline that highlights the most important steps to take during that particular year in high school. For example, during freshman year students should evaluate their class schedule, join an extracurricular activity, talk with their parents about saving money for college, etc. Students will share their group's timeline and students will record information on their own personal timeline to use throughout high school.

**Deliverable:** Students will be able to understand the components of a college timeline to utilize throughout high school.

**July 26, 2018**
**Topic:** College Roadmap
**Activity:** Students will create their own individual roadmap to college to utilize throughout high school. Students will determine specific academic courses, extracurricular activities, additional opportunities outside of school they would like to take advantage of (i.e. job shadowing, internships, etc.) to creatively display on their roadmap. Students will craft a presentation of their choosing (PowerPoint, poster board, video, etc.) to showcase their learnings throughout the summer workshops.

**Deliverable:** Students will create their own roadmap to college to utilize throughout high school.

**July 27, 2018**
**Topic:** College Roadmap Presentations
**Activity:** Students will deliver their college roadmap presentation to their peers. Students will learn how their peers intend to pursue postsecondary education. Students will reflect on their experience creating their roadmap and the importance of early college planning.

**Deliverable:** Students will be able to present orally to a group of peers their roadmap to college and goals for the future.
Introduction to Artificial Intelligence and Automation with Case Studies from Robotics and IoT

Instructor: Blake Hament, Ph.D. Candidate, (blake.hament@unlv.edu)  
Mechanical Engineering, University of Nevada, Las Vegas

Course Overview

This course is designed to introduce high-achieving middle and high school students to the practices of Artificial Intelligence and Automation (AIA) through hands-on activities and case studies with popular robots and Internet of Things (IoT) devices. Students will receive an overview of important programming concepts and how they relate to AIA, though no prior coding experience is required. Students will practice coding and AIA skills with educational games, daily coding activities, and a culminating programming project. This course is intended as a survey that covers essential topics for aspiring roboticists, IoT engineers, and other AIA professionals.

The first week of classes covers the basics of coding, computers, artificial intelligence, automation, and machine learning. Students will be introduced to important vocabulary, especially related to programming and statistics. Students will begin to build intuition around the characteristics, capabilities, and limitations of computers and artificial intelligence.

In the second week, students begin to consider how a computer might interact with the larger world. Topics include: communication protocols with humans and other machines, sensors, computer vision, actuation, and automated navigation. Students will conceptualize how computers capture various types of physical data from the environment and how computers use that data to make decisions. Students also explore how computers actuate by sending electrical signals to peripherals, like spinning a wheel with a motor or opening a valve via a solenoid.

The final week ties together all the topics introduced in Weeks 1 and 2 with robotics and IoT case studies. Students will investigate how AIA is put into action with self-driving cars and products like the iRobot Roomba and Amazon Alexa. The case studies explore hardware and software with live demonstrations and hands-on small group investigations. The final assessment is a practical exercise and fun competition in which students apply all they have learned in a culminating project. The culminating project asks students to work in groups to program an iRobot Roomba to navigate from point A to point B in a room filled with obstacles. Groups compete to find the fastest solution, iteratively revising and deploying their code as they learn from their experiments.
Daily Topic Outline

Week 1

1. Coding and Computers Part I
   a. Components of a Computer
   b. Operating Systems
   c. Programs and Applications
   d. Programming Languages
   e. Karel the Dog Activity

2. Coding and Computers Part II
   a. Types of Programming
      i. Embedded
      ii. Scripts
      iii. Programs
      iv. Web
      v. Front-end
      vi. Back-end
   b. Big Data
   c. The Cloud
   d. Grasshopper JS Activity

3. What is Artificial Intelligence and Automation? Part I
   a. If statements
      i. Else
      ii. Cases
   b. Loops
      i. For
      ii. While
   c. Scratch Video Game Activity

4. What is Artificial Intelligence and Automation? Part II
   a. Functions
   b. Controllers
      i. Open-loop
      ii. Closed-loop
   c. Blockly Function Activity

5. What is Machine Learning?
   a. Statistics
      i. Probability
      ii. Probability Distribution
      iii. Standard Deviation
   b. Optimization
      i. Minimization
      ii. Maximization
c. Classification and Regression  
d. TensorFlow Playground Activity

Week 2

a. Data Transfer  
   i. Wireless/wired  
   ii. Checking for listener  
   iii. Security  
   iv. Machine or People (m2p, m2m, p2m, p2p)  
b. Communication Protocols  
   i. Serial, USB  
   ii. Ethernet: LAN, WAN  
   iii. Wifi: UDP/TDP  
   iv. Bluetooth  
c. Terminal Activity

7. Sensors  
a. Kinect Demonstration  
b. Modalities  
   i. Temperature, Pressure, Light, Sound, Chemical, Radiation, Position (linear or angular), Velocity (l or a), Acceleration (l or a)  
c. Rangefinding with Light  
   i. Time of flight  
   ii. Phase difference  
   iii. LiDAR, IR  
   iv. 2D maps, 3D point clouds, Occupancy grids  
d. Sensor Investigation Activity

8. Computer Vision  
a. Image as a matrix  
b. Image processing techniques  
c. Recognizing road lines  
d. Object identification  
e. Photogrammetry  
f. OpenCV Activity  
g. Photogrammetry App Activity

9. Actuators  
a. Motors  
   i. Electric  
   ii. Fossil Fuel  
   iii. Pneumatic  
   iv. Hydraulic
b. Solenoids
   i. Valves
   ii. Switches

c. Applications
   i. Linear and Rotational Motion
   ii. HVAC
   iii. Interactions with humans

d. Manipulators and End-effectors
   i. Degrees of Freedom

e. Tools
f. Grippers
   i. Compliance
g. Robot Arm Investigation Activity

10. Navigation and Tool Path Planning
    a. Furo and Knightscope Demonstration
    b. Reaction-based (i.e. turn left algos)
    c. Occupancy Grids
    d. Search Trees
    e. Potential Fields
    f. iRobot Roombas Navigation Activity

Week 3

11. Amazon Alexa Case Study Part I
    a. Speech-to-Text/Text-to-Speech
    b. AI in action
    c. Data Analytics
12. Amazon Alexa Case Study Part II
    a. Iterative Design
    b. CAD
    c. TinkerCAD Activity
13. Self-Driving Cars Case Study
    a. Sensing Modalities
    b. PID Line Following
    c. Obstacle Avoidance
    d. Student Investigations/Presentations
14. iRobot Roomba Case Study Part I
    a. Roomba Code
    b. Programming Roomba with Scratch
15. iRobot Roomba Case Study Part II
    a. Final Assessment: Roomba Navigation Competition