Robotics 1

Curriculum Map 2010

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Robotics1: 20 weeks (semester 1)

Student Objectives
Based on Mathematical Practices from Common Core State Standards for Mathematics

1. Students make sense of problems and persevere in solving them
2. Students are able to reason abstractly and quantitatively
3. Students are able to defend their solutions and critique the reasoning of others
4. Students are able to create models using mathematical concepts
5. Students are able to use appropriate tools strategically.
6. Students will be able to create more precise alternative solutions with elegance
7. Students will look for and make use of structure and patterns
8. Students will look for and express regularity in repeated reasoning iteratively and recursively.

Standard CS Opening Exercise-
Good Group Work poser
Communication Activity: "One, two, three way communication"
Materials: set of numbered shape cards

Student equipment agreement- week 1
Check out and sign for their robot, managed by a pair and it must be returned the way the pair got it or fees will be assessed to bring kit back to the state of "complete kit".
Full replacement cost $300.00
Check list of what to look for will be included. Sign and date this list and the sign-out sheet/ parents.

Robotics1 Semester 1 Curriculum
5 Units- 3 weeks for each unit Students rotate through units in pairs

Sources:

1. UML TEAMS Wiki- Mazes
   http://www.cs.uml.edu/teams-academy/index.php/Robots/HomePage
   http://www.cs.uml.edu/teamsacademy/index.php/Explore/NewRobotSeminar
2. ALICE Text Randy Pausch
3. Roboni-i software Gaming robots http://www.robonica.com/
4. Computer Science Unplugged text- Computer theory and Computer science concepts
   Tim Bell, Ian H Witten and Mike Fellows
5. ArtBotics Grant from NSF Broadening participation in Computing Program
   Binder supplied from U-Mass Lowell Computer Science dept.

Grading:

Mazes	25%	5% each unit
Maze extensions	15%	
ALICE-bot projects	30%	5% each project
Quizzes	10%	Vocabulary and Concepts
Term Project	10%	
Dispositions	5%	
Attendance	5%	

Semester 1

Week 0-1 Pre-skills Alice tutorials ALICE ch 1-10
Week 2-4 Unit1 (Any unit A, B, C, D, E) 2 Lab days for ALICE/ Unplugged Lecture(s)
Week 5-7 Unit2 (Any unit A, B, C, D, E) 2 Lab days for ALICE/ Unplugged Lecture(s)
Week 8-10 Unit3 (Any unit A, B, C, D, E) 2 Lab days for ALICE/ Unplugged Lecture(s)
Week 11-13 Unit4 (Any unit A, B, C, D, E) 2 Lab days for ALICE/ Unplugged Lecture(s)
Week 14-16 Unit5 (Any unit A, B, C, D, E) 2 Lab days for ALICE/ Unplugged Lecture(s)
Tournament week 17 (Maze races and roboni tournaments)
Artbotics week 18-20 Finish Alice requirements

Each Unit A-E consists of:

Maze Students complete a maze and maze extension
ALICE Complete 2 ALICE projects (1-10)
Name of project: Students title every project with unique title describing project
Pages: Students reference page number from text
Two quizzes each unit based on Alice and Unplugged CS concept activities and lectures
Unplugged Activity

Four Mazes http://www.cs.uml.edu/teams-academy/index.php/Explore/NewRobotSeminar

a. The Wheelchair Museum Tour Line following
b. Power Out at the Mall Photophilic
c. Search-and-Rescue Mission Wall following
d. Build Your Own Roomba! Random processing
e. Roboni-I http://www.robonica.com/

Pre-skills Using LOGO language and compiler with robot

1. Move forward in a straight line of varied length
2. Square of varied sizes
3. Circle of varied sizes
4. Figure 8
5. Stop at wall with varied sensors
6. Stop at wall and reverse direction
7. Stop at wall and turn ending at start position
8. Stop if green line and go if orange line
9. Go if green line and stop if orange line
10. Cliff sensor

Term Papers Students choose a current events topic in robotics and write a report
- rubric for report will be provided to students.

ALICE projects All projects will have a robot theme

1. Introduction to syntax and structure
2. Program design and implementation- story board development
3. Functions and Control structures
4. Classes, objects, methods and parameters
5. Event handling
6. If/ else and boolean structures
7. While repetition and loops
8. Recursion
9. Lists
10. Variables and Inheritance

Unplugged Computer Science theory and activities

1. Binary and number systems
2. Image representation
3. Text Compression
4. Error detection and correction
5. Information theory
6. Searching algorithms
7. Sorting algorithms

8-10. Networking

11. Finite State automata
12. Programming Languages

	Massachusetts Learning Standards for Mathematics applied in Robotics1	**Example of Application(s) of the MA Learning Standards in this Robotics Curriculum**	**Common Core National Standards code**
10.N.4	Use estimation to judge the reasonableness of results of computations and of solutions to problems involving real numbers.	• Pre-skills • Maze A,B,C,D	N-Q 3
	Define appropriate quantities for the purpose of descriptive modeling.		N-Q 2
10.P.1	Describe, complete, extend, analyze, generalize, and create a wide variety of patterns, including iterative, recursive (e.g., Fibonnacci Numbers), linear, quadratic, and exponential functional relationships.	• Write code using iterative and/or recursive structure (Maze A,B,C,D). • Unplugged - Binary	A-REI 1
10.P.2	Demonstrate an understanding of the relationship between various representations of a line. Determine a line's slope and x- and y-intercepts from its graph or from a linear equation that represents the line. Find a linear equation describing a line from a graph or a geometric description of the line, e.g., by using the "point-slope" or "slope y-intercept" formulas. Explain the significance of a positive, negative, zero, or undefined slope.	• Write a program where the robot travels a desired route • (Maze A, Maze C).	F-IF 6
10.P.5	Find solutions to quadratic equations (with real roots) by factoring,	• Calculate the distance along the	A-SSE 3

	completing the square, or using the quadratic formula. Demonstrate an understanding of the equivalence of the methods.	length and width of the rectangle (Maze D).	
10.P.6	Solve equations and inequalities including those involving absolute value of linear expressions (e.g., |x - 2| > 5) and apply to the solution of problems.	• Distance calculations used to write programs where the robot travels to desired locations.	A-CED 1
10.G.1	Identify figures using properties of sides, angles, and diagonals. Identify the figures' type(s) of symmetry	• Sharpen communication skills and emphasize the importance of specific vocabulary (standard opening exercise).	
10.G.3	Recognize and solve problems involving angles formed by transversals of coplanar lines. Identify and determine the measure of central and inscribed angles and their associated minor and major arcs. Recognize and solve problems associated with radii, chords, and arcs within or on the same circle.	• Sharpen communication skills and emphasize the importance of specific vocabulary (standard opening exercise).	G- CO 1
10.G.5	Solve simple triangle problems using the triangle angle sum property and/or the Pythagorean theorem	• Maze B • Alice methods	F-TF 8
10.G.6	Use the properties of special triangles (e.g., isosceles, equilateral, 30º–60º–90º, 45º–45º–90º) to solve problems	• Maze B • Alice methods	
10.G.7	Using rectangular coordinates, calculate midpoints of segments, slopes of lines and segments, and distances between two points, and apply the results to the solutions of problems	• Maze C • Image representation	A-CED 1 A-CED 2
10.G.9	Draw the results, and interpret transformations on figures in the coordinate plane, e.g., translations, reflections, rotations, scale factors, and the results of successive	• Pre-skill 8 • Alice Projects	G-CO 2 G-CO 3 G- CO 4 G- CO 5

	transformations. Apply transformations to the solutions of problems.		
10.G.11	Use vertex-edge graphs to model and solve problems	• Unplugged Activity (networks)	
10.M.1	Calculate perimeter, circumference, and area of common geometric figures such as parallelograms, trapezoids, circles, and triangles.	• Maze D • Pre-skills	
10.M.2	Given the formula, find the lateral area, surface area, and volume of prisms, pyramids, spheres, cylinders, and cones, e.g., find the volume of a sphere with a specified surface area.	• Alice Projects- use of x, y, z plane	
10.M.3	Relate changes in the measurement of one attribute of an object to changes in other attributes, e.g., how changing the radius or height of a cylinder affects its surface area or volume.	• Alice Projects • Pre-skills	
10.M.4	Describe the effects of approximate error in measurement and rounding on measurements and on computed values from measurements.	• Pre-skills • Units A,B,C,D	
12.P.4	Demonstrate an understanding of the trigonometric, exponential, and logarithmic functions.	• Maze Extensions	F-TF 1 F-TF 2
12.P.5	Perform operations on functions, including composition. Find inverses of functions.	• Writing and interpreting code. • Pre-skills • Alice Projects • Maze A, B,C,D	A- SSE CE 3
AII.P.4	Demonstrate an understanding of the exponential and logarithmic functions	• Binary and number systems	R-RN 1 R-RN 2
AII.P.5	Perform operations on functions, including composition. Find inverses of functions.	• Functions in Alice	F-IF 1 F-IF 2 F-IF 3
AII.P.11	Solve everyday problems that can be modeled using polynomial, rational,	• Number systems	Modeling

	exponential, logarithmic, and step functions, absolute values and square roots.		
AII.P.12	Identify maximum and minimum values of functions in simple situations. Apply to the solution of problems	• Mazes	F-IF 4
AII.P.13	Describe the translations and scale changes of a given function *f*(x) resulting from substitutions for the various parameters a, b, c, and d in y = a*f* (b(x + c/b)) + d. In particular, describe the effect of such changes on polynomial, rational, exponential, and logarithmic functions.	• Alice projects	
	Use units as a way to understand problems and to guide the solution of multi-step problems.	• Unplugged Algorithms	N-Q 1