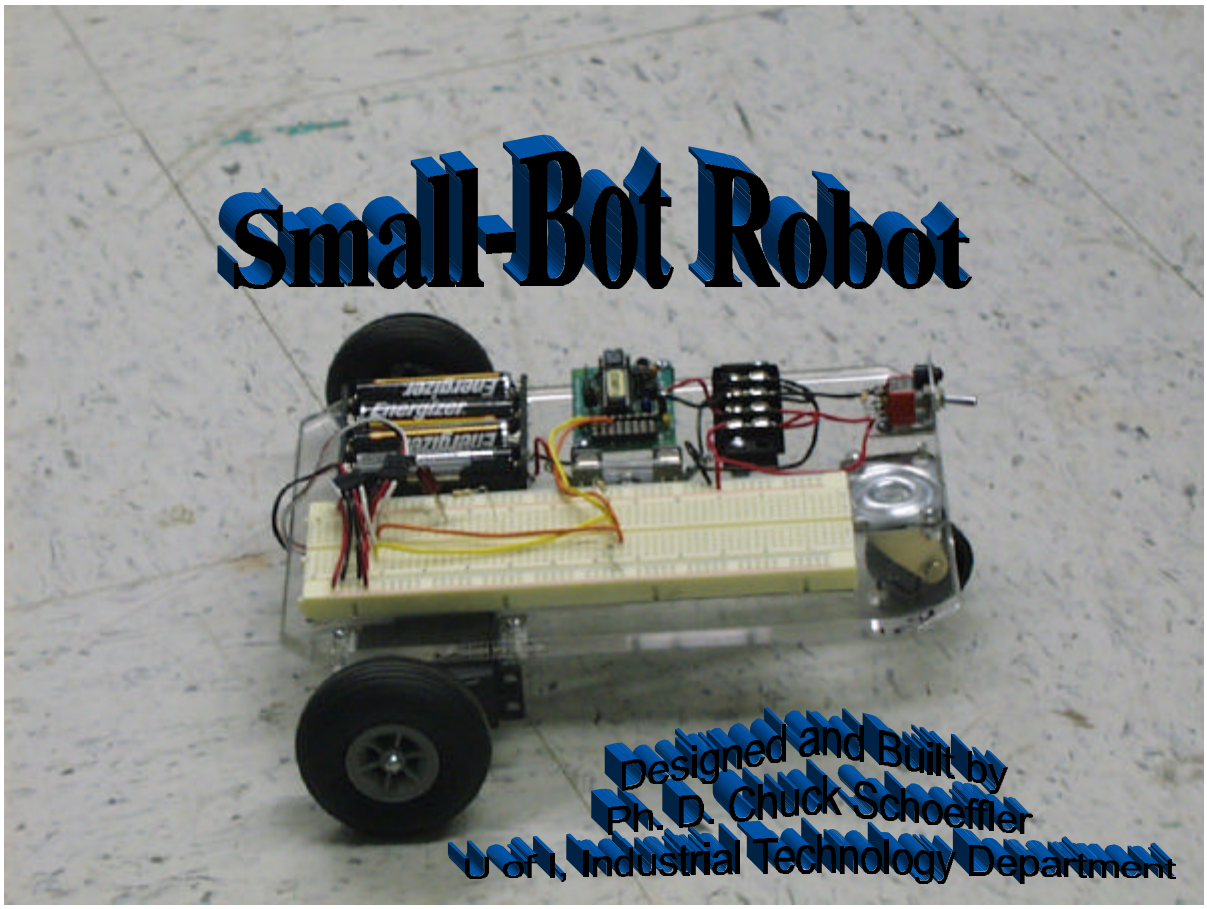
Micro-controllers and Robotics

Course Curriculum Guide DOT #638.261-026



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Acknowledgements

I recognize the contributions made in the development of this curriculum to Dr. Chuck Schoeffler at the University of Idaho, Industrial Technology Education Department for providing me with the insight to visualize the importance of training our secondary education students in the diversity of the work place. Also, a lot of credit is given to Mr. Gary Quinn at the Sandpoint High School located in Sandpoint, Idaho. Through Mr. Quinn's support, professionalism, and dedication to the advancement and improvement of his Introduction to Technology classes. Mr. Quinn also allowed me to revise and test this curriculum during my student teaching experience under his tutorship. Principal Mr. A. C. Woolnough receives special credit for the support and professionalism of the Sandpoint High School Administration and Staff for allowing me to have the opportunity to develop and test this program while doing my student teaching at the high school.

Lynxmotion, Inc., web address is http://www.lynxmotion.com and Dr. Chuck Schoeffler at the University of Idaho developed the Small-Bot robots used for this curriculum. The drawings listed in Appendix II of this curriculum were designed and developed by Dr. Chuck Schoeffler using Easy Cad Professional Drawing and Drafting Program Software.

The micro-controllers used for this program of instruction can be purchased from Parallax, Inc., wed address is http://www.parallaxinc.com and includes using the PBASIC programming language. The resources from Parallax are very user friendly and facilitate learning in secondary education classroom environment.

I have had a lot of enjoyment and fun in developing this program. I hope those who view this curriculum will have as much enjoyment as I have.

Introduction

This course is an introduction to micro-controller applications. The micro-controller and robotics curriculum helps students to apply information concerning various applications and relevancy of these important components used in the industrial work places and private small businesses. Micro-controllers find uses in various applications such as control mechanisms for robot regulated assembly lines, collecting data, and relaying information such as the use of controlling the anti-lock braking system in automobiles. Micro-controllers are also used in microwaves, toasters, televisions, and automatic feeds for chickens and fish tanks. Micro-controllers find applications in the automated manufacturing process, but also in research for the development and testing of new applications.

Micro-controllers are re-programmable; this allows the user to evaluate the program for errors, and allows the user to repair errors in the program instructions before final implementation. Also included in this course of instruction is the use of PBASIC communication language in which the students will learn to use key terms to program the micro-controller to control systems of various voltages and circuit designs.

The course will incorporate the social issues related to automation, the impact of diverse applications, simplicity of design, and physical characteristics of the micro-controller and its relationship to computer integration.

Course Philosophy

Demonstrate how micro-controllers can enhance and improve the applications used in automation and individual applications. Micro-controller usage has increased dramatically over the last ten to fifteen years. With the cost of micro-controllers dramatically dropping in price and their wide use in industry, the students require this advance knowledge in order to be better prepared for entering the work force. The course will incorporate the social issues related to automation, the impact of diverse applications, simplicity of design, and physical characteristics of the micro-controller and its relationship to computer integration.

Course Objectives

- Show relevancy of micro-controller applications.
- Demonstrate PBASIC computer language.
- Introduce the students to the diverse applications of micro-controllers to the field of technology.
- Prepare the student for entering the work place with relevant skills.
- Show students what current technology applies to the automated work institutions.
- Teach students how to connect electronic components to make a simple circuit.
- Teach students the use computer-programming languages to tell the micro-controller to turn on a light emitting diode (LED).
- Teach students the use computer-programming languages to tell the micro-controller to turn on several LED's in sequence.
- Teach students the use computer-programming languages to tell the micro-controller to make sound emit from a speaker.
- Teach students the use computer-programming languages to tell the micro-controller to interface a speaker and LED circuit design into performing sequential sound and lighting operations.
- Teach students how to interface higher voltage systems with a transistor and turn on an electric motorized fan.

Dictionary of Occupational Title Description and Applications

Robot technician (machinery mfg.) 638.261-026

Installs, programs, and repairs robot related equipment, such as programmable controllers, robot controllers, end-of-arm tools, conveyors, and part orientations. Applies knowledge of electronics, electrical circuits, mechanics, pneumatics, hydraulics, and programming skills using power tools, hand tools, and test instruments. Uses schematic blueprints, schematic diagrams, and manuals. Reviews work orders, related manuals, and technical documentation to determine tasks being performed and tools, equipment, and parts needed for installation of repair assignment. Discusses assignment with customer's representative and inspect installation site to verify that electrical supply wires, conduit, switches, and circuit breakers are installed according to specifications. Positions and secures robot and related equipment to the floor, assisted by customer's staff, using crane, hand tools, power tools, reference manuals, and technical schematics drawings and diagrams. Attaches electrical wire to robot controller and programmable controller and connect cables between robot, robot controller, programmable controller, and hydraulic power unit using hand tools. Verifies that electrical power is reaching the robot and that voltage is as specified using test equipment. Pushes buttons, flips switches, and moves levers to start robot and related equipment to verify operations. Programs robot to perform specific tasks, applying knowledge of programming language, using teach pendant and keyboard or control panel on robot controller. Modifies program to refine robot movement using the teaching pendant. Observes and listens to robot and related equipment to detect malfunction and repairs or replaces defective parts using hand tools and power tools (related to MAINTENANCE MECHANIC { any industry} 638.281-014).

Related Skills:

ROBOTIC MACHINE OPERATOR (aircraft mfg.) 606.382-026
Robotic machine tender, production (machine shop) 609.685-018
ELECTRONICS ASSEMBLER (comm. equip; electron. comp; inst. & app.) 726.684-018
ELECTRONICS ASSEMBLER, DEVELOPMENTAL (any industry) 726.261-010
ELECTRONICS-RESEARCH ENGINEER (profess. & kin.) 003.061-038
Electronics specialist (any industry) 828.261-022
Electronics supervisor (petrol. & gas) 710.131-034
Electronics-system mechanic (any industry) 828.261-022
Electronics technician (any industry) 823.281-018
Electronics technician (any industry) 828.261-022
ELECTRONICS TECHNICIAN (profess. & kin.) 003.161-014

Electronics-technician apprentice (any industry) 828.261-026
Electronics Technician, Nuclear Reactor (profess. & kin.) 003.161-014
ELECTRONICS-TEST ENGINEER (profess. & kin.) 003.061-042
ELECTRONICS TESTER (any industry) 726.261-018
ELECTRONICS TESTER (comm. equip; electron. comp; inst. & app; office machines) 726.684-026

Duties of the Instructor

- Prepares and presents lessons to students.
- Prepares course of instruction designed to meet the needs of the community, businesses, and students needs.
- Prepares course information, which employs and relates new advances in technological applications.
- Develops laboratory experiences for student participation in applying theories and facts into a hands-on learning environment.
- Conduct class meetings and presents information about the course of instruction using lectures, discussion, demonstration, learning by experimentation (self-awareness), laboratory exercises (hands-on learning), and electronic media such as the Internet, cd-rom, videos, and computers.
- Complies, administers, and grades examinations or final projects for final evaluations.
- Performs related duties, such as counseling and advising students on activities and requirements related to the course of their normal educational experiences.

Student Tasks

Task 1: Develop a program for the performance of a human robot to move its way through the Human robot Maze Activity using the following commands: Take 1 Step Forward, Turn Left, Turn Right, Kneel Down, Stand Up, Sit down, Close Hand, Open Hand, Short Low Tone Double Beep, and a Short Single High Tone Beep.

Task 2: Demonstrate the uses of micro-controllers.

Task 3: Demonstration the use of PBASIC computer programming language.

Task 4: Write a routine that makes the servomotor move to the center position using the following commands Center, Pulsout, Pause, Goto.

Task 5: Write a routine that makes the SM-bot robot move forward 12 inches using the FOR/NEXT loop, Pulsout, Pause, Next, and Return commands.

Task 6: Write a routine that makes the SM-bot robot execute a 90 degree turn to the left using the FOR/NEXT loop, Pulsout, Pause, Next, and Return commands.

Task 7: Write a routine that makes the SM-bot robot execute a 90 degree turn to the right using the FOR/NEXT loop, Pulsout, Pause, Next, and Return commands.

Task 8: Write a program using the routines discussed and demonstrated using Tasks 4 through 6 routines and each of the routines associated commands.

Task 9: Demonstrate the ability to integrate basic electronic circuits with the micro-controller.

Task 10: Demonstrate the use electronic circuit components such as a resistor and an LED.

Task 11: Demonstrate how to program the micro-controller to flash one LED simple circuit design ten times using the TOGGLE and PAUSE commands.

Task 12: Demonstrate how to program the micro-controller to flash four LED's circuit designs sequentially ten times using the FOR/NEXT loop commands.

Task 13: Demonstrate how to design a speaker circuit and integrate it with the micro-controller.

Task 14: Demonstrate how to program the micro-controller to produce a sound from the speaker using the SOUND command.

Task 15: Demonstrate how to make a speaker produce a song by programming the micro-controller with the SOUND command.

Task 16: Demonstrate how to design a four LED and speaker circuit and integrate with the micro-controller.

Task 17: Demonstrate how to program the four LED's to flash sequentially and have the speaker produce a sound scale when the third LED flashes.

Task 18: Demonstrate how to design and interface a higher voltage circuit system with a transistor and turn on an electric motor with a micro-controller.

Units of Instruction

1. Introduction to micro-controllers.

2. Introduction to the routines and commands used for programming the SM-Bot robot.

   A. Forward
   B. Lturn
   C. Rturn
   D. Center
   E. For/Next Loop
   F. Pulsout
   G. Pause
   H. Next
   I. Return
   J. Gosub
   K. Goto
   L. End

3. Introduction to electronic components:

   A. LED's
   B. Resistor's
   C. Capacitor's
   D. Speakers
   E. Chip set (BS1 Rev D)
   F. Transistors
   G. Motors
   H. Servomotors

4. Introduction to circuit design.

5. Introduction to circuit connections.

6. Introduction to PBASIC language:

   A. Toggle
   B. Pause
   C. High
   D. Low
   E. Sound

Robotics Internet Search

Objective: Students search the Internet for the first reference to the term robot.

Directions: Log on to Internet and use your favorite search engine to find the earliest term referring to robots. Provide the exact web site address, the author's name, and the date the term was first utilized. Write a brief short paragraph describing the article on the computer or using a typewriter.

Sample format is provided below:

Student Name: _____ Period: _____

Web address: _____

Author's Name: _____

Earliest date showing first use of the term "robot": _____

Article description: _____

_____

_____

_____

_____

_____

Human Robot Activity

Lesson Plan 1

Objective: Provides the students with the ability to visually apply and communicate programmable commands from one individual to the next.

Directions: Students shall work in-groups. Each group will select one member to work as the robot while the other members of the group will develop the robot program using the commands listed below. Remember: The natural position of the robot is with the arm out forward, elbow bent alongside of the hip with the hand open. Each group will be provided 30 minutes to take up the program to follow the maze and perform the activities/goals listed below.

Activities/Goals: (Steps 2 through 5 can be performed in any sequence.)

1. Enter the maze.
2. Pickup the trash and make a short high tone single beep sound signaling end of activity.
3. Put trash in the trashcan and make a short low tone double beep sound signaling the end of the activity.
4. Sit down in the chair.
5. Stand up in front of the chair.
6. Exit from the maze.

Commands:

Take one step forward
Turn left
Turn right
Kneel down
Stand up
Sit down
Open hand
Close hand
Short low tone double beep
Short high tone single beep

Use the Human Robot Maze listed in Appendix 1 as Figure 1.

Human Robot Maze Commands

Group Member Names: Period: _____

_____

_____

_____

_____

_____

Commands:

_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

Lesson Plan 2

Introduction to Robotics

1. Introduction to the Laws of robotics
2. Introduction to Micro-controllers

Robotic Resources:

1. Asfahl, C. Ray, "*Robots and Manufacturing Automation*," Second Edition, 1992, ISBN #0-471-55391-3
2. Capek, Karl, "*R.U.R.*"1929
3. McComb, Gordon, "*Robot Builder's Bonanza, 99 Inexpensive Robotics Projects*," 1987 ISBN #0-8306-2800-2
4. Flynn, Anita M. and Jones, Joseph L. "*Mobile Robots, Inspiration to Implementation*," 1993, ISBN #1-56881-011-3
5. Parallax Basic (PBASIC) Software, Version 1.9
6. Robot Rising Video from the Discovery Channel

Basic Laws of Robotics: Taken from Karl Capek's play R. U. R. of 1922.

Law 1: Robots cannot all a human to be harmed.

Law 2: Robots cannot allow a human to be harmed through its own action or inaction's.

Law 3: robots cannot destroy themselves without violating Laws 1 and 2.

General Information:

1. All robot programmers, researchers, and scientists have adopted these three laws into the development of robot research to ensure the protection of the human race from destruction by mechanical devices.

2. The term ROBOT is derived from the Czech word *robota*, which means work.

3. A robot is re-programmable, multi-functional manipulator designed to move material, parts, tools, or specialized devices through variable programmed motions for the performance of a variety of tasks.

4. Also robots are designed to perform hazardous operations demeaned unsafe for humans to perform. Examples include: Cleaning up the nuclear waste at INEEL, The Chernobyl Nuclear Power plant meltdown and subsequent explosion, bomb detection and removal by the police departments.

5. Explorations of the Pyramids in the Valley of the Kings, exploration of volcanic craters are other examples of robotic applications.

Robotics Automation and Programming

Lesson Plan 3

Objective: Show the students how specific commands can be used to make a robot move in a certain direction.

Commands to use for this instruction method:

- Forward: ‘Designates the routine name.

For B2= 0 to 255

- For ‘Identifies the beginning of the program.
  - B2 ‘Byte name where the internal counter starts ‘and ends.
  - 0 or 1 ‘Assigns the starting number of the program.
  - To 255 ‘Assigns the ending number of the program.

Pulsout 1, 160

- Pulsout ‘Pulse generated by the stamp to invert the ‘assigned pin for a specific duration of time.
  - 1 ‘Assigns the pin number where the right motor is ‘connected.
  - , 160 ‘Makes the motor move the right side of the ‘robot move forward.

Pulsout 2,140

- Pulsout ‘Pulse generated by the stamp to invert the ‘assigned pin for a specific duration of time.
  - 2 ‘Assigns the pin number where the left motor is ‘connected.
  - ,140 ‘Left motor rotates in CCW direction

Pause 20

- Pause ‘Allows the servomotor to rest for a designed ‘amount of time to reset and allow the system to ‘resume operation.
  - 20 ‘System pauses operation for 20 milli-seconds.
- Next ‘Identifies when the program has reached the ‘end.
- Return ‘Next routine.

Robotics Automation and Programming Assignment 2

Student Name: _____

Period: _____

Date: _____

Purpose: Provide the student with information concerning programming the robot to move forward 12 inches.

Commands:	Remarks:

```
'Program name is FORWARD.BAS, developed by Lester J. Snoderly.
'Program written is Sandpoint, ID. for teaching the Introduction
'to Technology Robotics Program.
'Servos used for the rover robot are the Futaba S3003's.
'Left servo connected to Pin 1, stop position is 149.
'Right servo is connected to Pin 2, stop position is 148.
'-----------------------------------------------------------------
Forward:          'Program routine name for moving the robot forward.

for b2= 0 to 63   'FOR designated the beginning of the program.
                  'Makes the robot move forward 12 inches.
                  'Assigns the program to byte name b2, where
                  'the counter starts and ends the program.
                  'Starts the count at 0 and ends at 63.
pulsout 1,140     'Stamp sends a pulse to pin 1, and causes
                  'the left servo to rotate in the CCW direction
                  'moving the robots left side forward.
pulsout 2,160     'Stamp sends a pulse to pin 2, and causes
                  'the right servo to rotate in the CW direction
                  'moving the robots right side forward.
pause 20          'Pauses the servo motion for 20 milliseconds
                  'and allows the servo to reset before continuing
                  'on with the count.
next              'Identifies the end of the program.
```

Robotics Automation and Programming

Lesson Plan 4

Objective: Show the students how specific commands can be used to make a robot perform a left 90-degree turn.

Commands to use for this instruction method:

- Lturn: ‘Designates the title of the routine.

For B3= 0 to 45

- For ‘Identifies the beginning of the program.
  - B3 ‘Byte name where the internal counter starts ‘and ends.
  - 0 or 1 ‘Assigns the starting number of the program.
  - To 45 ‘Assigns the ending number of the program.

Pulsout 1,160

- Pulsout ‘Pulse generated by the stamp to invert the ‘assigned pin for a specific duration of time.
  - 1 ‘Assigns the pin number where the right motor ‘is connected.
  - , 160 ‘Makes the motor move the right side of the ‘robot move forward.

Pulsout 2,150

- Pulsout ‘Pulse generated by the stamp to invert the ‘assigned pin for a specific duration of time.
- 2 ‘Assigns the pin number where the left motor is ‘connected.
- ,149 ‘Keeps the left servomotor stationary at its ‘center position.

Pause 20

- Pause ‘Allows the servomotor to rest for a designed ‘amount of time to reset and allow the system to ‘resume ‘operation.
- 20 ‘System pauses operation for 20 milli-seconds.
- Next ‘Identifies when the program has reached the ‘end.
- Return ‘Next routine

Robotics Automation and Programming Assignment 3

Student Name: _____

Period: _____

Date: _____

Purpose: Provide the student with information concerning programming the robot to make a left 90-degree turn.

Commands:	Remarks:

```
'Program filename is LTURN.BAS written by Lester J. Snoderly
'for Introduction to Technology Robotics Program at the Sandpoint
'High School in Sandpoint, ID on 22 September 1998.
'Servomotors used for this robot are the Futaba S3003.
'Left servomotor is connected to Pin 1, center position is 149.
'Right servomotor is connected to Pin 2, center position is 148.
'-----------------------------------------------------------------
Lturn:            'Designates a left turn routine.
For b3= 0 to 48   'FOR assigns the beginning of the program.
                  'Makes the robot turn left 90 degrees.
                  'Assigns the program to byte name b3, where the
                  'counter starts with 0 pulses and ends with
                  '48 pulses.
Pulsout 1,149     'stamp sends a pulse to Pin 1, this causes the
                  'left motor to remain stationary in the stop
                  'position.
Pulsout 2,160     'Stamp send a pulse to Pin 2, this causes
                  'the right motor to rotate forward in the CW
                  'direction.
Pause 20          'Pauses the servomotor for 20 mS (milli-seconds)
                  'and allows the servo to reset before continuing
                  'on with the rest of the count.
Next              'Identifies the end of the program.
'-------------------------------------------------------------------------------
```

Robotics Automation and Programming

Lesson Plan 5

Objective: Show the students how specific commands can be used to make a robot perform a right 90-degree turn.

Commands to use for this instruction method:

- Rturn: ‘Designates the title of the routine.

For b4= 0 to 45

- For ‘Identifies the beginning of the program.
  - B4 ‘Byte name where the internal counter starts ‘and ends.
  - 0 or 1 ‘Assigns the starting number of the program.
  - To 45 ‘Assigns the ending number of the program.

Pulsout 1,150

- Pulsout ‘Pulse generated by the stamp to invert the ‘assigned pin for a specific duration of time.
  - 1 ‘Assigns the pin number where the right motor ‘is connected.
  - , 150 ‘Keeps the right side motor stationary.

Pulsout 2,140

- Pulsout ‘Pulse generated by the stamp to invert the ‘assigned pin for a specific duration of time.
  - 2 ‘Assigns the pin number where the left motor is ‘connected.
  - ,140 ‘Left motor rotates forward in the CCW direction.

Pause 20

- Pause ‘Allows the servomotor to rest for a designed ‘amount of time to reset and allow the system to resume ‘operation.
  - 20 ‘System pauses operation for 20 milli-seconds.
  - Next ‘Identifies when the program has reached the ‘end.
  - Return ‘Next routine.

Robotics Automation and Programming Assignment 4

Student Name: _____

Period: _____

Date: _____

Purpose: Provide the student with information concerning programming the robot to make a 90-degree right turn.

Commands:	Remarks:

```
'Program filename is RTURN.BAS written by Lester J. Snoderly
'for Introduction to Technology Robotics Program at the Sandpoint
'High School in Sandpoint, ID on 22 September 1998.
'Servomotors used for this robot are the Futaba S3003.
'Left servomotor is connected to Pin 1, center position is 149.
'Right servomotor is connected to Pin 2, center position is 148.
'-----------------------------------------------------------------
Rturn:            'Designates a right turn routine.
For b4= 0 to 54   'FOR assigns the beginning of the program.
                  'Makes the robot turn right 90 degrees.
                  'Assigns the program to byte name b4, where the
                  'counter starts with 0 pulses and ends with
                  '54 pulses.
Pulsout 1,140     'stamp sends a pulse to Pin 1, this causes the
                  'left motor to rotate in the CCW direction.
Pulsout 2,148     'Stamp send a pulse to Pin 2, this causes
                  'the right motor to remain stationary in the
                  'stop position.
Pause 20          'Pauses the servomotor for 20 mS (milli-seconds)
                  'and allows the servo to reset before continuing
                  'on with the rest of the count.
Next              'Identifies the end of the program.
'-------------------------------------------------------------------
```

Robotics and Automation Programming

Lesson Plan 6

Objective: Shows the students how to combine Lessons 3 through 5 (Forward, Lturn, and Rturn) into a completed program to move the robot through a maze configuration. Here we also introduce the commands GOTO, GOSUB, and END statements.

Instructions:

1. Place the GOTO command at the end of the last routine below the return command followed by the program name.
2. Now place the program name following the GOTO statement at the beginning of the routines followed by the colon (:).
3. Recall the subroutines by using the GOSUB statement up to a total of sixteen (16) times.
4. After the program is written with the GOSUB statements follow the program with and END statement.
5. Use the following example shown below:

Commands to use for this instruction method:

Commands	Comments or Remarks
➢ Maze:	‘Program name.
Gosub Forward	‘Calls up and executes the Forward routine.
Gosub Lturn	‘Calls up and executes the Lturn routine.
Gosub Forward	‘Calls up and executes the Forward routine.
Gosub Rturn	‘Calls up and executes the Rturn routine.
Gosub Forward	‘Calls up and executes the Forward routine.
Gosub Rturn	‘Calls up and executes the Rturn routine.
Gosub Rturn	‘Calls up and executes the Rturn routine.
Gosub Forward	‘Calls up and executes the Forward routine.
➢ End	‘Designates the end of the program.

➢ Forward:	‘Designates the routine name.
For B2= 0 to 255	
➢ For	‘Identifies the beginning of the program.
➢ B2	‘Byte name where the internal counter starts ‘and ends.
➢ 0 or 1	‘Assigns the starting number of the program.

Command	Comments or Remarks
➢ To 255	‘Assigns the ending number of the program.
Pulsout 1, 160	
➢ Pulsout	‘Pulse generated by the stamp to invert the ‘assigned pin for a specific duration of time.
➢ 1	‘Assigns the pin number where the right motor ‘is connected.
➢ , 160	‘Makes the motor move the right side of the ‘robot move forward.
Pulsout 2,140	
➢ Pulsout	‘Pulse generated by the stamp to invert the ‘assigned pin for a specific duration of time.
➢ 2	‘Assigns the pin number where the left motor is ‘connected.
➢ ,140	‘Left motor rotates in CCW direction
Pause 20	
➢ Pause	‘Allows the servomotor to rest for a designed ‘amount of time to reset and allow the system to ‘resume operation.
➢ 20	‘System pauses operation for 20 milli-seconds.
➢ Next	‘Identifies when the program has reached the ‘end.
➢ Return	‘Next routine.
➢ Lturn:	‘Designates the title of the routine.
For B3= 0 to 45	
➢ For	‘Identifies the beginning of the program.
➢ B3	‘Byte name where the internal counter starts ‘and ends.
➢ 0 or 1	‘Assigns the starting number of the program.
➢ To 45	‘Assigns the ending number of the program.
Pulsout 1,160	
➢ Pulsout	‘Pulse generated by the stamp to invert the ‘assigned pin for a specific duration of time.

Command	Comments or Remarks
➢ 1	‘Assigns the pin number where the right motor ‘is connected.
➢ , 160	‘Makes the motor move the right side of the ‘robot move forward.
Pulsout 2,150	
➢ Pulsout	‘Pulse generated by the stamp to invert the ‘assigned pin for a specific duration of time.
➢ 2	‘Assigns the pin number where the left motor is ‘connected.
➢ ,149	‘Keeps the left servomotor stationary at its ‘center position.
Pause 20	
➢ Pause	‘Allows the servomotor to rest for a designed ‘amount of time to reset and allow the system to ‘resume ‘operation.
➢ 20	‘System pauses operation for 20 milli-seconds.
➢ Next	‘Identifies when the program has reached the ‘end.
➢ Return	‘Next routine
➢ Rturn:	‘Designates the title of the routine.
For b4= 0 to 45	
➢ For	‘Identifies the beginning of the program.
➢ B4	‘Byte name where the internal counter starts ‘and ends.
➢ 0 or 1	‘Assigns the starting number of the program.
➢ To 45	‘Assigns the ending number of the program.
Pulsout 1,150	
➢ Pulsout	‘Pulse generated by the stamp to invert the ‘assigned pin for a specific duration of time.
➢ 1	‘Assigns the pin number where the right motor ‘is connected.

Commands	Comments or Remarks
➢ , 150 Pulsout 2,140	‘Keeps the right side motor stationary.
➢ Pulsout	‘Pulse generated by the stamp to invert the ‘assigned pin for a specific duration of time.
➢ 2	‘Assigns the pin number where the left motor is ‘connected.
➢ ,140 Pause 20	‘Left motor rotates forward in the CCW direction.
➢ Pause	‘Allows the servomotor to rest for a designed ‘amount of time to reset and allow the system to ‘resume operation.
➢ 20	‘System pauses operation for 20 milli-seconds.
➢ Next	‘Identifies when the program has reached the ‘end.
➢ Return	‘Next routine.
➢ Goto Maze	‘Tells the micro-controller to proceed to the ‘program name. (In this case Maze is the ‘program ‘name.)

Robotics Automation and Programming Assignment 5

Student Name: _____

Period: _____

Date: _____

Purpose: Provide the student with information concerning programming the robot to write a program using the previous learned routines and develop a program that makes a robot perform the previous learned exercises in a maze setup.

Commands:	Remarks:

Commands:

Remarks:

Commands:

Remarks:

Maze Program Problem Solving Exercise

Student Name: _____ Period: _____

Problem: The following program contains a minimum of 14 errors. The errors are in both the program Command and Comment sections of the program. Remember that 12 inches is represented by the FOR b2= 0 to 63. Also a 90 degree turn is represented by the FOR b3= 0 to 44.

Directions: Read the program carefully. Your task is to look effectively over the program and identify the errors. As you locate each error circle the error and record the problem below in the appropriate Command section or Comment section located below. Make sure than you place the error in the correct location. For each error you identify you must place the correct response directly below the error.

Commands	Comments

Commands	Comments

```
          Problem Identification Sheet for Instructor's Use Only.
'Program name is MAZE2.BAS, developed by Lester J. Snoderly.
'Program written is Sandpoint, ID. for teaching the Introduction
'to Technology Robotics Program, dated 24 September, 1998.
'Servos used for the rover robot are the Futaba S3003's.
'Left servo connected to Pin 0, stop position is 149.
'Right servo is connected to Pin 1, stop position is 148.
'-----------------------------------------------------------------------

Forward:          'Program routine name for moving the robot forward.

for b2= 0 to 189  'FOR designated the beginning of the program.
                  'Makes the robot move forward 30 inches.
                  'Assigns the program to byte name b2, where
                  'the counter starts and ends the program.
                  'Starts the count at 0 and ends at 155.
pulsout 0,170     'Stamp sends a pulse to pin 0, and causes
                  'the right servo to rotate in the CCW direction
                  'moving the robots right side forward.
pulsout 1,126     'Stamp sends a pulse to pin 1, and causes
                  'the left servo to rotate in the CW direction
                  'moving the robots left side forward.
pause 20          'Pauses the servo motion for 20 milliseconds
                  'and allows the servo to reset before continuing
                  'on with the count.
next              'Identifies the end of the program.
Return            ‘Goes to next routine.
'-----------------------------------------------------------------------

Lturn:            'Routine name for robot turning left
for b3= 0 to 44   'makes robot turn left 90 degrees
pulsout 0,170     'right mtr CW direction
pulsout 1,149     'stops left mtr
pause 20          'pauses mtrs for 20 mS
next              'ends program
Return            ‘goes to next routine
'-----------------------------------------------------------------------

Forward:          'Routine name for move robot forward
for b4= 0 to 124  'makes robot fwd 24 inches
pulsout 0,170     'left mtr fwd CCW direction
pulsout 1,126     'right mtr fwd CCW direction
pause 20          'pauses mtrs for 20 mS
next              'ends program
Return            ‘goes to next routine.
'-----------------------------------------------------------------------

Lturn:            'Routine name for robot turning left
for b3= 0 to 44   'makes robot turn left 90 degrees
pulsout 0,170     'left mtr CW direction
pulsout 1,149     'stops right mtr
pause 20          'pauses mtrs for 20 mS
next              'ends program
return            ‘goes to next program
'-----------------------------------------------------------------------

Forward:          'Program routine name for moving the robot forward.
```

```
for b2= 0 to 63   'makes robot fwd 12 inches
pulsout 0,170     'left mtr fwd CCW direction
pulsout 1,126     'right mtr fwd CCW direction
pause 20          'pauses mtrs for 20 mS
next              'ends program
return            ‘goes to next routine
'-----------------------------------------------------------------------

Rturn:            'routine name for making right turn
for b4= 0 to 45   'makes robot turn right 90 degrees
pulsout 0,148     'stops right mtr
pulsout 1,126     'left mtr fwd CW direction
pause 20          ‘pauses mtrs for 20 mS
next              'ends program
return            ‘goes to next routine
'-----------------------------------------------------------------------

forward:          'makes robot move forward
for b2= 0 to 94   'moves robot fwd 24 inches
pulsout 0,170     'left mtr fwd CCW direction
pulsout 1,126     'right mtr fwd CW direction
pause 20          'pauses mtrs for 20 mS
next              'ends program
return            ‘Goes to next routine
'-----------------------------------------------------------------------

Lturn:            'Routine name for robot turning left
for b3= 0 to 44   'makes robot turn left 90 degrees
pulsout 0,170     'right mtr CW direction
pulsout 1,149     'stops left mtr
pause 20          'pauses mtrs for 20 mS
next              'ends program
return            ‘goes to next routine
'-----------------------------------------------------------------------

Forward:          'Program routine name for moving the robot forward.
For b2= 0 to 155  'FOR designated the beginning of the program.
                  'Makes the robot move forward 36 inches.
                  'Assigns the program to byte name b2, where
                  'the counter starts and ends the program.
                  'Starts the count at 0 and ends at 155.
Pulsout 0,170     'Stamp sends a pulse to pin 0, and causes
                  'the right servo to rotate in the CCW direction
                  'moving the robots right side forward.
Pulsout 1,126     'Stamp sends a pulse to pin 1, and causes
                  'the right servo to rotate in the CCW direction
                  'moving the robots left side forward.
Pause 20          'Pauses the servo motion for 20 milliseconds
                  'and allows the servo to reset before continuing
                  'on with the count.
Next              'Identifies the end of the program.
Return            ‘goes to next routine.
'-----------------------------------------------------------------------
```

Program to Problem Solve for Students use.

```
'Program name is MAZE2.BAS, developed by Lester J. Snoderly.
'Program written is Sandpoint, ID. for teaching the Introduction
'to Technology Robotics Program, dated 24 September, 1998.
'Servos used for the rover robot are the Futaba S3003's.
'Left servo connected to Pin 0, stop position is 149.
'Right servo is connected to Pin 1, stop position is 148.
'-----------------------------------------------------------------------

Forward:          'Program routine name for moving the robot forward.

for b2= 0 to 189  'FOR designated the beginning of the program.
                  'Makes the robot move forward 30 inches.
                  'Assigns the program to byte name b2, where
                  'the counter starts and ends the program.
                  'Starts the count at 0 and ends at 155.
pulsout 0,170     'Stamp sends a pulse to pin 0, and causes
                  'the right servo to rotate in the CCW direction
                  'moving the robots right side forward.
pulsout 1,126     'Stamp sends a pulse to pin 1, and causes
                  'the left servo to rotate in the CW direction
                  'moving the robots left side forward.
pause 20          'Pauses the servo motion for 20 milliseconds
                  'and allows the servo to reset before continuing
                  'on with the count.
next              'Identifies the end of the program.
Return            ‘goes to next routine.
'-----------------------------------------------------------------------

Lturn:            'Routine name for robot turning left
for b3= 0 to 44   'makes robot turn left 90 degrees
pulsout 0,170     'right mtr CW direction
pulsout 1,149     'stops left mtr
pause 20          'pauses mtrs for 20 mS
next              'ends program

'-----------------------------------------------------------------------

Forward:          'Routine name for move robot forward
for b4= 0 to 124  'makes robot fwd 24 inches
pulsout 0,170     'left mtr fwd CCW direction
pulsout 1,126     'right mtr fwd CCW direction
pause 20          'pauses mtrs for 20 mS
next              'ends program
return            ‘goes to next routine
'-----------------------------------------------------------------------

Lturn:            'Routine name for robot turning left
for b3= 0 to 44   'makes robot turn left 90 degrees
pulsout 0,170     'left mtr CW direction
pulsout 1,149     'stops right mtr
pause 20          'pauses mtrs for 20 mS

Return            ‘goes to next routine
'-----------------------------------------------------------------------

Forward:          'Program routine name for moving the robot forward.
```

```
for b2= 0 to 63   'makes robot fwd 12 inches
                  'leftt mtr fwd CCW direction
pulsout 1,126     'right mtr fwd CCW direction
pause 20          'pauses mtrs for 20 mS
next              'ends program
return            ‘goes to next routine
'-------------------------------------------------------------------------

Rturn:            'routine name for making right turn
for b4= 0 to 45   'makes robot turn right 90 degrees
pulsout 0,148     'stops right mtr
pulsout 1,126     'left mtr fwd CW direction
pause 20          ‘pauses mtrs for 20 mS
next              'ends program
return            ‘goes to next routine
'-------------------------------------------------------------------------

forward:          'makes robot move forward
for b2= 0 to 94   'moves robot fwd 24 inches
pulsout 0,170     'left mtr fwd CCW direction
pulsout 1,126     'right mtr fwd CW direction
pause 20          'pauses mtrs for 20 mS
next              'ends program
'-------------------------------------------------------------------------

Lturn:            'Routine name for robot turning left
for b3= 0 to 44   'makes robot turn left 90 degrees
pulsout 0,170     'right mtr CW direction
pulsout 1,149     'stops left mtr
pause 20
next              'ends program
return            ‘goes to next routine
'-------------------------------------------------------------------------

Forward:          'Program routine name for moving the robot forward.
For b2= 0 to 155  'FOR designated the beginning of the program.
                  'Makes the robot move forward 36 inches.
                  'Assigns the program to byte name b2, where
                  'the counter starts and ends the program.
                  'Starts the count at 0 and ends at 155.




Pulsout 1,126     'Stamp sends a pulse to pin 1, and causes
                  'the left servo to rotate in the CCW direction
                  'moving the robots left side forward.
Pause 20



                  'Identifies the end of the program.
Return            ‘goes to next routine
'-------------------------------------------------------------------------
```

Solution to Problem Solving Exercise Instructor's Original Copy

```
'Program name is MAZE2.BAS, developed by Lester J. Snoderly.
'Program written is Sandpoint, ID. for teaching the Introduction
'to Technology Robotics Program, dated 24 September, 1998.
'Servos used for the rover robot are the Futaba S3003's.
'Left servo connected to Pin 0, stop position is 149.
'Right servo is connected to Pin 1, stop position is 148.
'-----------------------------------------------------------------------

Forward:          'Program routine name for moving the robot forward.

for b2= 0 to 155  'FOR designated the beginning of the program.
                  'Makes the robot move forward 30 inches.
                  'Assigns the program to byte name b2, where
                  'the counter starts and ends the program.
                  'Starts the count at 0 and ends at 155.
pulsout 0,170     'Stamp sends a pulse to pin 0, and causes
                  'the left servo to rotate in the CCW direction
                  'moving the robots left side forward.
pulsout 1,127     'Stamp sends a pulse to pin 1, and causes
                  'the right servo to rotate in the CW direction
                  'moving the robots right side forward.
pause 20          'Pauses the servo motion for 20 milliseconds
                  'and allows the servo to reset before continuing
                  'on with the count.
next              'Identifies the end of the program.
Return            ‘goes to next routine
'-----------------------------------------------------------------------

Lturn:            'Routine name for robot turning left
for b3= 0 to 44   'makes robot turn left 90 degrees
pulsout 0,148     'stops left mtr
pulsout 1,127     'right mtr CW direction
pause 20          'pauses mtrs for 20 mS
next              'ends program
return            ‘goes to next routine
'-----------------------------------------------------------------------

forward1:         'Routine name for move robot forward
for b4= 0 to 124  'makes robot fwd 24 inches
pulsout 0,170     'left mtr fwd CCW direction
pulsout 1,127     'right mtr fwd CW direction
pause 20          'pauses mtrs for 20 mS
next              'ends program
return            ‘goes to next routine
'-----------------------------------------------------------------------

Lturn1:           'Routine name for robot turning left
for b5= 0 to 44   'makes robot turn left 90 degrees
pulsout 0,148     'stops left mtr
pulsout 1,127     'right mtr CW direction
pause 20          'pauses mtrs for 20 mS
next              'ends program
return            ‘goes to next routine
'-----------------------------------------------------------------------

Forward2:         'Program routine name for moving the robot forward.
```

```
for b6= 0 to 63   'makes robot fwd 12 inches
pulsout 0,170     'left mtr fwd CCW direction
pulsout 1,127     'right mtr fwd CW direction
pause 20          'pauses mtrs for 20 mS
next              'ends program
return            ‘goes to next routine
'-------------------------------------------------------------------------

Rturn:            'routine name for making right turn
for b7= 0 to 44   'makes robot turn right 90 degrees
pulsout 0,170     'Left mtr fwd CCW direction
pulsout 1,149     'right mtr stopped
pause 20          ‘pauses mtrs for 20 mS
next              'ends program
return            ‘goes to next routine
'-------------------------------------------------------------------------

forward3:         'makes robot move forward
for b8= 0 to 94   'moves robot fwd 18 inches
pulsout 0,170     'left mtr fwd CCW direction
pulsout 1,127     'right mtr fwd CW direction
pause 20          'pauses mtrs for 20 mS
next              'ends program
return            ‘goes to next routine
'-------------------------------------------------------------------------

Lturn2:           'Routine name for robot turning left
for b9= 0 to 44   'makes robot turn left 90 degrees
pulsout 0,148     'stops left mtr
pulsout 1,127     'right mtr CW direction
pause 20          'pauses mtrs for 20 mS
next              'ends program
return            ‘goes to next routine
'-------------------------------------------------------------------------

Forward4:         'Program routine name for moving the robot forward.
For b10= 0 to 155 'FOR designated the beginning of the program.
                  'Makes the robot move forward 30 inches.
                  'Assigns the program to byte name b10, where
                  'the counter starts and ends the program.
                  'Starts the count at 0 and ends at 155.
Pulsout 0,170     'Stamp sends a pulse to pin 0, and causes
                  'the left servo to rotate in the CCW direction
                  'moving the robots left side forward.
Pulsout 1,127     'Stamp sends a pulse to pin 1, and causes
                  'the right servo to rotate in the CW direction
                  'moving the robots right side forward.
Pause 20          'Pauses the servo motion for 20 milliseconds
                  'and allows the servo to reset before continuing
                  'on with the count.
Next              'Identifies the end of the program.
Return            ‘goes to next routine
'-------------------------------------------------------------------------
```

Robotics Exam 1

Directions: Read the following problem, before writing your robot program routines. Remember for every command you provide for the program the appropriate comment must follow that command. You have the full class period to complete this exercise. The quiz is worth 50 points.

Problem: Your robot has two motors connected to the micro-controller stamp pins 1 and 2. The left servomotor is connected to pin 2, with a stop position of 150. The right servomotor is connected to pin 1, with a stop position of 150. The robot is placed at the entrance to the maze. Use the dimensions listed on the maze to move the robot from the entrance to the exit using the forward, left turn and right turn commands we discussed and demonstrated in class over the last two days. Write the routines as we discussed in class.

Values needed for this exercise:

1. Servomotors stop values are 150
2. Right servo connected to pin 1
3. Left servo connected to pin 2
4. Use 20 numbers above and below 150 to designate the speed of the motors.
5. Remember: For b2=0 to 63 makes the robot move forward 12 inches.

Commands allowed to be used for this exercise:

Forward
Lturn
Rturn
For
Next
Return
Pulsout
Pause

Use Maze in the appendix labeled Figure 2.

Name: _____ Period: _____

Commands:	Comments/Remarks:

Commands:

Comments/Remarks:

Name: _____Answer Key_____ Period: _____

Commands:	Comments/Remarks:
Forward:	‘Routine name
For b2=0 to 157	‘moves robot fwd 30 inches
Pulsout 1,170	‘Right motor fwd in CW direction
Pulsout 2,130	‘Left motor fwd in CCW direction
Pause 20	‘Resets or pauses motors for 20 mS
Next	‘Ends routine
Return	“Designate next routine to go to
Lturn:	‘Routine name
For b3= 0 to 50	’Makes robot turn left 90 degrees
Pulsout 1,170	‘Right motor fwd in CW direction
Pulsout 2, 150	‘Stops left motor from turning
Pause 20	‘Resets or pauses motors for 20 mS
Next	‘Ends routine
Return	‘Designates next routine to perform
Forward1:	‘Routine name
For b4=0 to 126	‘Moves robot forward 24 inches
Pulsout 1, 170	‘Right motor fwd in CW direction
Pulsout 2, 130	‘Left motor fwd in CCW direction
Pause 20	‘Resets or pauses motors for 20 mS
Next	‘Ends routine
Return	‘Designates next routine to perform
Lturn1:	‘Routine name
For b5=0 to 50	‘Performs a 90 degree left turn
Pulsout 1,170	‘Right motor fwd in CW direction

```
Pulsout 2,150                ‘Stops left motor
Commands:                    Comments/Remarks:
Pause 20                     ‘Resets and pauses motors for 20 mS
Next                         ‘Ends program
Return                       ‘Designates next routine to perform

Forward2:                    ‘Routine name
For b6=0 to 63               ‘Robot moves fwd 12 inches
Pulsout 1,170                ‘Right motor fwd in CW direction
Pulsout 2,130                ‘Left motor fwd in CCW direction
Pause 20                     ‘Resets or pauses motors for 20 mS
Next                         ‘Ends program
Return                       ‘Designates next routine to perform

Rturn:                       ‘Routine name
For b7= 0 to 50              ‘Robot makes a 90 degree turn to the right
Pulsout 1, 150               ‘Stops right motor
Pulsout 2,130                ‘Left motor fwd in the CCW direction
Pause 20                     ‘Resets or pauses motors for 20 mS
Next                         ‘Ends program
Return                       ‘Designates next routine to perform

Forward3:                    ‘Routine name
For b8= 0 to 94              ‘Moves robot forward 18 inches
Pulsout 1,170                ‘Right motor fwd in CW direction
Pulsout 2,130                ‘Left motor fwd in CCW direction
Pause 20                     ‘Resets or Pauses motor for 20 mS
Next                         ‘Ends program
Return                       ‘Designates next routine to perform

Lturn2:                      ‘Routine name
```

```
For b9= 0 to 50                 'Makes robot turn left 90 degrees
Commands:                       Comments/Remarks:
Pulsout 1,170                   'Right motor fwd in CW direction
Pulsout 2,150                   'Stops left motor
Pause 20                        'Resets and pauses motors for 20 mS
Next                            'Ends program
Return                          'Designates next routine to perform

Forward4:                       'Routine name
For b10= 0 to 94                'Robot moves forward 18 inches
Pulsout 1,170                   'Right motor fwd CW direction
Pulsout 2,130                   'Left motor fwd in CCW direction
Pause 20                        'Resets or pauses motors for 20 mS
Next                            'Ends routine
```

Robotics Take Home Exam 2

Directions: Read the following problem, before writing your robot program routine. Remember for every command you provide for the program the appropriate comment must follow that command. You have the full class period to complete this exercise. The quiz is worth 50 points. With this problem there is no chance for a retake to improve your test score because it is a take home exam. **Use your notes!**

Problem: Your robot has two motors connected to the micro-controller stamp pins 1 and 2. The left servomotor is connected to pin 1, with a stop position of 150. The right servomotor is connected to pin 2, with a stop position of 150. The robot is placed at the entrance to the maze. Use the dimensions listed on the maze to move the robot from the entrance to the exit using the forward, left turn and right turn routines we discussed and demonstrated in class over the last two days. Make sure that the block (B2) usage are in sequential order and that if you use forward and any other routines more than once they are designated in sequential order.

Values needed for this exercise:

2. Servomotors stop values are 150
2. Right servo connected to pin 2
3. Left servo connected to pin 1
6. Use 20 numbers above and below 150 to designate the speed of the motors.
7. Remember: For b2=0 to 63 makes the robot move forward 12 inches.
8. Remember: For b3=0 to 44 makes the robot turn 90 degrees.

Commands allowed to be used for this exercise:

Forward
Lturn
Rturn
For
Next
Return
Pulsout
Pause

EXTRA! EXTRA! CREDIT: worth ten points if correctly done. Write the program to make the program move through the maze using the routines you just completed and use the Goto and Gosub statements.

Name: _____ Period: _____

Commands:	Comments/Remarks:

Commands:

Comments/Remarks:

_____ _____

_____ _____

Name: _____Answer Key_____ Period: _____

Commands:	Comments/Remarks:
Maze:	‘Program Name
Gosub Forward	‘Calls up and executes sub-routine Forward
Gosub Lturn	‘Calls up and executes sub-routine Lturn
Gosub Forward1	‘Calls up and executes sub-routine Forward1
Gosub Lturn	‘Calls up and executes sub-routine Lturn
Gosub Forward3	‘Calls up and executes sub-routine Forwrd3
Gosub Rturn	‘Calls up and executes sub-routine Rturn
Gosub Forward3	‘Calls up and executes sub-routine Forward3
Gosub Rturn	‘Calls up and executes sub-routine Rturn
Gosub Forward4	‘Calls up and executes sub-routine Forward4
Gosub Lturn	‘Calls up and executes sub-routine Lturn
Gosub Forward1	‘Calls up and executes sub-routine Forward1
End	‘Ends Program
Forward:	‘Routine name
For b2=0 to 157	‘moves robot fwd 30 inches
Pulsout 1,170	‘Right motor fwd in CW direction
Pulsout 2,130	‘Left motor fwd in CCW direction
Pause 20	‘Resets or pauses motors for 20 mS
Next	‘Ends routine
Return	“Designate next routine to go to
Lturn:	‘Routine name
For b3= 0 to 44	’Makes robot turn left 90 degrees
Pulsout 1,170	‘Right motor fwd in CW direction
Pulsout 2, 150	‘Stops left motor from turning

```
Pause 20                ‘Resets or pauses motors for 20 mS
Next                    ‘Ends routine
Commands                Comments

Return                  ‘Designates next routine to perform

Forward1:               ‘Routine name
For b4=0 to 94          ‘Moves robot forward 18 inches
Pulsout 1, 170          ‘Right motor fwd in CW direction
Pulsout 2, 130          ‘Left motor fwd in CCW direction
Pause 20                ‘Resets or pauses motors for 20 mS
Next                    ‘Ends routine
Return                  ‘Designates next routine to perform

Lturn1:                 ‘Routine name
For b5=0 to 44          ‘Performs a 90 degree left turn
Pulsout 1,170           ‘Right motor fwd in CW direction
Pulsout 2,150           ‘Stops left motor
Commands:               Comments/Remarks:
Pause 20                ‘Resets and pauses motors for 20 mS
Next                    ‘Ends program
Return                  ‘Designates next routine to perform

Forward2:               ‘Routine name
For b6=0 to 63          ‘Robot moves fwd 12 inches
Pulsout 1,170           ‘Right motor fwd in CW direction
Pulsout 2,130           ‘Left motor fwd in CCW direction
Pause 20                ‘Resets or pauses motors for 20 mS
Next                    ‘Ends program
Return                  ‘Designates next routine to perform
```

```
Rturn:                  ‘Routine name
For b7= 0 to 44         ‘Robot makes a 90 degree turn to the right
Commands                Comments

Pulsout 1, 150          ‘Stops right motor
Pulsout 2,130           ‘Left motor fwd in the CCW direction
Pause 20                ‘Resets or pauses motors for 20 mS
Next                    ‘Ends program
Return                  ‘Designates next routine to perform

Forward3:               ‘Routine name
For b8= 0 to 31         ‘Robot forward 6 inches
Pulsout 1,170           ‘L motor CCW direction
Pulsout 2,130           ‘R Motor CW Direction
Pause 20                ‘Pauses servomotors for 20 mS
Next                    ‘Ends routine
Return                  ‘Goes to next routine

Forward4:               ‘Routine name
For b9= 0 to 16         ‘Robot forward 3 inches
Pulsout 1,170           ‘L motor CCW direction
Pulsout 2,130           ‘R Motor CW Direction
Pause 20                ‘Pauses servomotors for 20 mS
Next                    ‘Ends routine
Return                  ‘Goes to next routine
GOTO Maze:
```

Robot Maze Final Project

Team Name: _____

Team Members: _____

_____

_____

Period: _____

Portfolio Presentation Requirements: Your team portfolio must include the following information:

- Cover Sheet:
  - Team Name.
  - Picture of a robot in color centered on the cover sheet.
  - Names of team members.
  - Date of final project and presentation.
  - Class you are enrolled in.
- Description of the project:
  - Describe the type of robot you are programming.
  - List the kind of programming language you are using.
  - Provide a written description of the maze you are programming the robot to move through.
- Copy of the Internet search for the term robot you submitted to complete the course requirements.
- Copy of your test.
- First draft of your programming instructions for the final maze project.
- Final draft of your robot maze program.
- A brief description of what you learned during the course of instruction listing the uses of the commands and the purpose of using remarks and or comments.
- A team self-assessment and grading sheet.

Maze Programming Guidelines

Objective: Program the Small-bot to move through the maze with accuracy. Do not touch the interior walls. Move the robot through the maze with the least amount of commands.

Directions: Analyze the maze very carefully. Plan your program to move through the maze using routines. Write routines for every command that make the robot move through the maze. Make sure that you provide a remark for every command that you use in the program. After you write the routines then develop the program using the GOTO and GOSUB statements.

Remember:

1. That in order to find the distance traveled by the servomotors the pulsout numbers will be different for each motor.
2. That the direction of movement for each servomotor is based upon the center positions for each motor.
3. That for the routines you must use the block names (b2 through b13) in the FOR statement.

Self-Assessment and Team Evaluation Sheet

Introduction to Technology "Robotics Maze Programming and Portfolio"

NAME: _____ Period: _____

Team Members:

_____

_____

_____

_____

_____

_____

Rate yourself and your team members on the contributions to this project.

1. List who you felt contributed the most amount of time to the following tasks. Also give the percentage time spent by yourself and your team member(s).

	Contributed Most	Contributed Some	Contributed Least
Maze Analysis	_____ _____%	_____ _____%	_____ _____%
Develop Routine Structure	_____ _____%	_____ _____%	_____ _____%
Write the Routine Using Computer	_____ _____%	_____ _____%	_____ _____%
Develop Program Using Routines	_____ _____%	_____ _____%	_____ _____%
Testing Robot	Contributed Most	Contributed Some	Contributed Least

Programming	_____	_____	_____
	_____%	_____%	_____%
	Contributed Most	Contributed Some	Contributed Least
Revising and Edit the Robot Program	_____	_____	_____
	_____%	_____%	_____%
	Contributed Most	Contributed Some	Contributed Least
Conducted and Presented the Completed Programmed Robot moving In the maze	_____	_____	_____
	_____%	_____%	_____%
	Contributed Most	Contributed Some	Contributed Least
Took Digital Photographs	_____	_____	_____
	_____%	_____%	_____%
	Contributed Most	Contributed Some	Contributed Least
Imported Digital Picture into the Cover sheet	_____	_____	_____
	_____%	_____%	_____%
	Contributed Most	Contributed Some	Contributed Least
Developed the Portfolio and Final Project	_____	_____	_____
	_____%	_____%	_____%

2. When different phases of the project had to be performed who was the most cooperative and least cooperative. Provide specific examples of the task performed.

Most Cooperative_____ Least Cooperative_____

3. List in a brief paragraph, the tasks or phases of the robot project that you were personally responsible for in completing the project.

4. List the positive and negative aspects of this project. Give specific examples.

Positive—

Negative—

5. What ways would you improve the course? Provide specific examples.

6. Please list the most important aspects that you feel helped you understand the importance of robotics in today's society and the use of high tech equipment used during this project.

7. Please list any aspect of the robot project that you feel were confusing and need to be re-evaluated.

8. Use the following space to address any issues or comments that you feel are important concerning yourself or your team members.

Portfolio Presentation Assessment Sheet

Course Breakdown of Point System:

1. The portfolio presentation is worth a total of 250 points.
2. The maze project is worth 100 points.
3. The robot test was worth 50 points.
4. The Internet search was worth 25 points.
5. The total points allowed for the course is 425 points.

Portfolio Presentation:

	Points Allowed	Points Earned
1. Coversheet	50	_____
2. Description of Project	25	_____
3. Copy of Internet Search	10	_____
4. Copy of Test	10	_____
5. Maze First Draft Program	50	_____
6. Maze Final Draft Program	75	_____
7. Description of the Course	15	_____
8. Team Self-Assessment	15	_____