



Cognite Intellectual Services

Inspiring Innovation

ROBOTICS STUDY MATERIAL

SCHOOL LEVEL 1

SEMESTER 2

Contents

UNIT-3.....	4
NXT-PROGRAMMING.....	4
CHAPTER-1	5
NXT- PROGRAMMING.....	5
CHAPTER-2	6
NXT-BRICK PROGRAMMING.....	6
A. Multiple choice questions:	9
B. Fill in the blanks:.....	9
C. Answers the following questions:.....	9
CHAPTER-3	12
NXT- G PROGRAMMING.....	12
COMMON PALETTE.....	12
CUSTOM PALETTE.....	13
A. Fill in the blanks.....	14
B. Answer the following questions:	14
C. Multiple choice questions:	15
CHAPTER-4	16
SOUND IN LEGO	16
SOUND BLOCK IN NXT-G SOFTWARE.....	16
HOW TO DOWNLOAD SOFTWARE PROGRAM INTO NXT-BRICK	17
Fill in the blanks:.....	17
Multiple choice questions:.....	17
Answer the following Questions.....	18
CHAPTER-5	19
DISPLAY BLOCK (Display using NXT brick)	19
Fill in the blanks:.....	20
Multiple choice questions.....	20
Answer the following questions:	20
CHAPTER-6	21
MOVE BLOCK.....	21
Configuring the move block	21
Types of turns.....	21
Fill in the blanks:.....	24

Disclaimer:

*All rights reserved. This book or any portion thereof may not be reproduced or used in any manner whatsoever without the express written permission of **Cognite Intellectual Services** except for the use of brief quotations in a book review.*

	3
Multiple Choice Questions:.....	24
Answer the following questions:	24
UNIT-4	26
WAIT FOR BLOCK	26
CHAPTER-1	27
WAIT BLOCK.....	27
Wait for time	27
Wait for touch block.....	28
Wait for sound block.....	28
Wait for light block	29
Wait for distance block.....	30
CHAPTER-2	31
WAIT FOR TOUCH BLOCK.....	31
Fill in the blanks:.....	35
Multiple choice questions:.....	35
Answer the following questions:	35
CHAPTER-3	37
WAIT FOR DISTANCE BLOCK.....	37
Ultrasonic sensor:-.....	37
Answer the following questions:	39
Fill in the blanks:.....	40

Disclaimer:

*All rights reserved. This book or any portion thereof may not be reproduced or used in any manner whatsoever without the express written permission of **Cognite Intellectual Services** except for the use of brief quotations in a book review.*

UNIT-3

NXT-PROGRAMMING

Disclaimer:

*All rights reserved. This book or any portion thereof may not be reproduced or used in any manner whatsoever without the express written permission of **Cognite Intellectual Services** except for the use of brief quotations in a book review.*

CHAPTER-I

NXT- PROGRAMMING

Robots are created for some specific function and to make the robot to work as desired, programming is needed. So for programming either NXT-Brick Programming or NXT-G Software Programming can be used.

NXT-PROGRAMMING is divided into two parts:

- i. NXT-Brick Programming
- ii. NXT-G Software Programming

Computers are not always necessary for programming. For some simple tasks, NXT-Brick Programming could also be used.

But when it comes to complex programming or making a robot to accomplish the complex task NXT-G Software Programming will be needed.

Disclaimer:

*All rights reserved. This book or any portion thereof may not be reproduced or used in any manner whatsoever without the express written permission of **Cognite Intellectual Services** except for the use of brief quotations in a book review.*

CHAPTER-2

NXT-BRICK PROGRAMMING

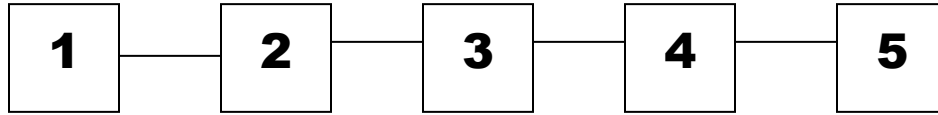


Fig 3.2(i)

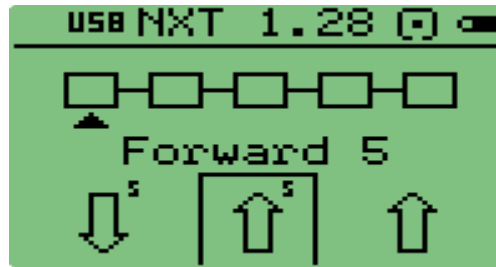



Fig 3.2(ii) 5 Blocks of NXT-Brick Programming

NXT-BRICK Programming is under the "NXT Program" icon in brick. Press  (enter button or orange button) to enter the option.

NXT Brick Programming has five blocks among which Block1 and Block3 have same set of instruction, Block2 and Block4 have same set of instruction and Block 5 has two different instructions within it.

Functions of different blocks

Block 1 and 3

The first and third blocks can contain actions that make the robot move or play a sound. For viewing all the 15 different actions navigation buttons can be used for it.



Fig3.2(iii) Different instruction for 1st and 3rd block

Disclaimer:

All rights reserved. This book or any portion thereof may not be reproduced or used in any manner whatsoever without the express written permission of **Cognite Intellectual Services** except for the use of brief quotations in a book review.

There are 14 different instructions in Block1 and Block3. They are as follows:

- Forward / reverse arrow: This will move the robot in forward/reverse direction until it moves to the next instruction block.
- Forward / reverse for 5 sec: This will move the robot in forward / reverse direction for 5 sec.
- Turn right / left: Robot will turn 90 degrees to its right / left using this instruction.
- Turn right / left conditional : Robot will turn to its right / left continuously until it gets some condition
- Back right / back left: It works same as that of turn right / left in the backward direction.
- Back right / back left conditional: It works same as that of turn right / left conditional in the backward direction.
- Tone 1 and 2: There are two tones available for programming i.e. Tone1 and Tone2.

Block 2 and 4

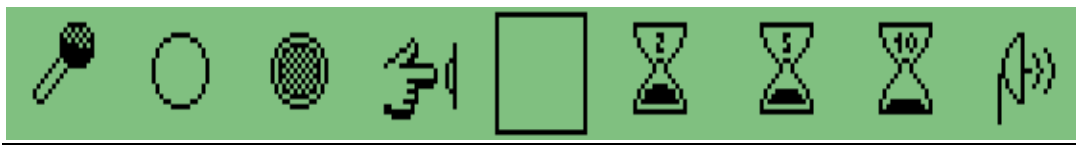


Fig3.2 (iv) Different instruction for 2nd and 4th block

The second and fourth blocks contain *wait-for conditions* that make the robot move continuously until the condition is satisfied. For viewing all the blocks, navigate it using the navigation buttons for all the nine different conditions:

- Empty: For directly switching to the next instruction then empty instruction can be used.
- Wait: This instruction can be used as wait for timer (2 sec, 5 sec, and 10 sec), wait for ultrasonic sensor, light sensor, sound sensor or touch sensor.

Block 5: Stop/Loop



Fig3.2 (v) 5th Block of NXT Brick Programming

Disclaimer:

All rights reserved. This book or any portion thereof may not be reproduced or used in any manner whatsoever without the express written permission of **Cognite Intellectual Services** except for the use of brief quotations in a book review.

- Stop: This instruction will end the program and make robot stop after this.
- Loop: All the instructions will be repeated in loop.



Program the robot using touch condition such that when the obstacle is detected bot should move backward for 2sec and stop.

.....

.....

.....

.....

.....

.....



Program robot without using the touch condition such that when the obstacle is detected robot should move backward for 2sec and stop.

.....

.....

.....

.....

.....

.....

Disclaimer:

All rights reserved. This book or any portion thereof may not be reproduced or used in any manner whatsoever without the express written permission of **Cognite Intellectual Services** except for the use of brief quotations in a book review.



CAN YOU ANSWER THIS?

A. Multiple choice questions:

- i) If the robot is supposed to move forward for 5 seconds which command should be given?
- a. Backward 5 b. Turn left 5 c. Forward 5 d. Forward
- ii) In NXT Program, the options present for block number 5 are
- a. Stop b. Loop c. Stop and Loop d. None of these
- iii) How many tone option are present in NXT Brick Programming?
- a. 1 b. 2 c. 3 d. 4
- iv) Two blocks which have same options of instruction, what is the corresponding number for those blocks?
- a. 1 and 2 b. 2 and 3 c. 1 and 3 d. None of these
- v) If dark light is to be detected which command will be given to block 2?
- a. Wait for object b. Wait for dark c. Wait for light d. Wait for touch

Answers: i) c ii) c iii) b iv) c v) b

B. Fill in the blanks:

- 1) "Turn Left" instruction will make the robot to move indirection.
- 2) instruction will be used to switch to another instruction.
- 3) There areblocks present in NXT Program.
- 4) The command which is given to end the program is called
- 5)is used to wait for timer of 2 seconds.
- 6) After giving command robot will move in the backward right direction for timer of 2 seconds.

Answers: 1) Left 2) Empty 3) Five 4) Stop 5) Wait 2 6) Back right 2

C. Answers the following questions:

1. Which command should be given to turn the robot in left direction?

Answer: Turn Left

2. Which instruction will be given to make a circular path by the robot?

Disclaimer:

All rights reserved. This book or any portion thereof may not be reproduced or used in any manner whatsoever without the express written permission of **Cognite Intellectual Services** except for the use of brief quotations in a book review.

Answer: Programming steps for making a circular path is:

- Turn left
- Empty
- Empty
- Empty
- Loop.

3. Which instruction will be used to repeat all the instruction given in the previous 4 blocks?

Answer: Loop

4. Write the program for a rectangular path which will be made by robot.

Answer: Programming steps for making rectangular path are:

- Forward
- Wait 5
- Turn Left 2
- Empty
- Loop.

5. Write the program for detecting the wall without touching it.

Answer: Programming steps for detecting a wall without touching it are:

- Forward
- Wait for object
- Tone1
- Empty
- Stop.

6. What are the different timer options for wait?

Answer: wait 2, wait 5 and wait 10

7. Write the program for detecting a wall by touching it.

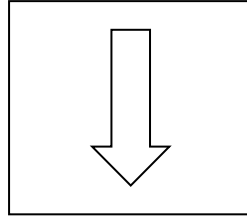
Answer: Programming steps for detecting a wall by touching it are:

- Forward,
- Wait for touch
- Tone1
- Empty
- Stop

Disclaimer:

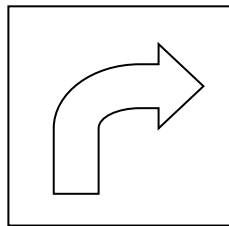
*All rights reserved. This book or any portion thereof may not be reproduced or used in any manner whatsoever without the express written permission of **Cognite Intellectual Services** except for the use of brief quotations in a book review.*

8. What is the meaning of this symbol?



Answer: Move in Backward direction.

9. Write the instruction for this symbol shown below



Answer: Move in right direction.

10. What will the robot do if “Forward 5” command is given?

Answer: The robot will move in forward direction for 5 seconds.

Disclaimer:

All rights reserved. This book or any portion thereof may not be reproduced or used in any manner whatsoever without the express written permission of **Cognite Intellectual Services** except for the use of brief quotations in a book review.

CHAPTER-3

NXT- G PROGRAMMING

There are some drawbacks of NXT-Brick Programming. There are certain limitations in NXT-Brick Programming as it has inbuilt NXT instruction. Complex programming cannot be done using NXT Brick Programming. NXT G Programming software is used to create complex and long programs.

To simplify its use, the programming palette has been divided into three different palette groupings: **the Common palette, the Complete palette and the Custom palette** (containing blocks that are created or download from the web). The Common palette is recommended as a starting point.



Fig3.3 (i) Different Pallet of NXT-G Software

COMMON PALETTE

MOVE BLOCK

The Move block makes the robot motors move. For any movement in robot move block is needed.

RECORD/PLAY BLOCK

The Record/Play block enables to program the robot with physical movement and later replay the movement elsewhere in the program.

WAIT BLOCK

Disclaimer:

*All rights reserved. This book or any portion thereof may not be reproduced or used in any manner whatsoever without the express written permission of **Cognite Intellectual Services** except for the use of brief quotations in a book review.*

The Wait block makes the robot wait for sensor input. For Example: Wait for sound block will wait for sound and wait for time block will wait for a time interval.

SOUND BLOCK

The Sound block enables the robot to make sounds, including pre-recorded words.

LOOP BLOCK

The Loop block makes the robot continue to do the same things again and again until the end condition is not met, such as moving forward and backward until a 'Touch Sensor' is pressed.

DISPLAY BLOCK

The Display block enables to control the display on the NXT- Brick. This block can display text, show icons or even draw using program.

SWITCH BLOCK

The Switch block enables the robot to make its own decisions between two different conditions, such as going left when it hears a loud sound and turning right when it hears a soft sound. Switch Block is also called Decision- Making Block.

It is similar to general If else statement.

CUSTOM PALETTE

MY BLOCKS

My Blocks enables to save a program as a single block so that it can be re-used in other programs.

WEB DOWNLOADS

The Web Downloads block saves the programs that are downloaded from e-mail, Portal or from any website.

Disclaimer:

*All rights reserved. This book or any portion thereof may not be reproduced or used in any manner whatsoever without the express written permission of **Cognite Intellectual Services** except for the use of brief quotations in a book review.*



CAN YOU ANSWER THIS?

A. Fill in the blanks

- 1)is the starting palette in NXT-G software.
- 2) The block which is used to make wait for sometime or to take a sensors reading is called
- 3) Move block is used tothe robot.
- 4) If some instructions are to be repeated then block should be used.
- 5)is used as a decision making block for robot which helps to make decision.
- 6) The block which contains my blocks and web downloads is called
- 7) There are types of palette in NXT-G Software.

Answers: 1) Common palette 2) Wait block 3) Move
 4) Loop 5) Switch block 6) Custom block 7) Three

B. Answer the following questions:

- 1) What are the types of the palette?

Answer: Common Palette, Custom Palette and Complete Palette.

- 2) What are the blocks present in the custom blocks?

Answer: My blocks and web downloads.

- 3) Why programming is necessary?

Answer: Program is set of commands which are given to the robot to perform any particular task. To perform that task programming is necessary.

- 4) What are the types of the programming methods?

Answer: NXT program and NXT-G programming.

- 5) Why NXT program is not used for complex programming?

Disclaimer:

All rights reserved. This book or any portion thereof may not be reproduced or used in any manner whatsoever without the express written permission of **Cognite Intellectual Services** except for the use of brief quotations in a book review.

Answer: In NXT program only 5 blocks are present to do program and we have only limited options for instruction.

C. Multiple choice questions:

1) Which block is present in common palette?

- a) Move b) Display c) a and b d) None of these

2) For a robot to wait for some time, which block should be use?

- a) Wait block b) Time block c) Second block d) None of these

3) Which block is **not** present in common block?

- a) Sound block b) Display block c) My block d) Record and play

4) Which block is also known as decision making block?

- a) loop block b) switch block c) web download d) series block

5) Which block can be used as a speaker of the robot?

- a) Display block b) Speaker block c) Sound block d) Move block

Answers: 1) c 2) a 3) c 4) b 5) c

Disclaimer:

All rights reserved. This book or any portion thereof may not be reproduced or used in any manner whatsoever without the express written permission of **Cognite Intellectual Services** except for the use of brief quotations in a book review.

CHAPTER-4

SOUND IN LEGO

MAKING SOUND USING NXT-BRICK

- NXT brick has the ability to play sound using inbuilt speakers.
- Different tones and sound files can be played in series to make a new melody of tones.

SOUND BLOCK IN NXT-G SOFTWARE

Sound blocks are used to play different sounds in NXT brick. To compose a melody of tones several sound blocks in a row are arranged with each set to play different tones.

- Select ‘Wait for completion’ in the configuration panel for a particular sound file or tone to finish playing before the program moves on to the next block.
- Uncheck it, the sound file or tone will continue to play while the next block of the program proceeds.
- If ‘Repeat’, is chosen a particular sound file will play again and again

The sound may be any pre recorded sound or any sound file or even a tone.

Its configuration and extension activity are given below:

1. The ‘Action’ property radio buttons allows choosing and playing a sound file or a tone that can be composed.



Fig 3.4 (i) Configuration Panel of Sound Block

Sound File

2. Choose “Play” or “Stop” a sound file or tone.
3. Also the volume can be changed using the slider. Use the text field to type in an exact value. If play is chosen for a sound file, some additional properties could also be set:

Disclaimer:

*All rights reserved. This book or any portion thereof may not be reproduced or used in any manner whatsoever without the express written permission of **Cognite Intellectual Services** except for the use of brief quotations in a book review.*

4. The 'Function' property will allow setting the sound file to repeat so that it plays again and again without stopping. The 'Wait for completion' option will be grayed out and no longer available.
5. The 'File' property will allow choosing the sound file by its name. An alphabetical list of all the available sounds can be seen. These are stored in the 'Sound Files' folder of the LEGO MINDSTORMS software on the hard drive. When a particular word is clicked a voice can be heard pronouncing the word.
6. If 'Wait for Completion' checkbox is checked, the sound file will play to its end before allowing the program to move to the next block. With the box unchecked, the sound file will play while the next block in the program proceeds. If the next block is another Sound Block, the first Sound file will stop automatically and the new Sound file will play.

HOW TO DOWNLOAD SOFTWARE PROGRAM INTO NXT-BRICK

- Make sure the NXT-Brick is turned on and connect the USB cable to both computer and the NXT-Brick.
- Locate the Controller in the lower right corner of the work area. Click Download and run (the center button) and listen to what happens.

The USB port and wireless Bluetooth connection are used for downloading and uploading data between computer and the NXT-Brick. If computer has Bluetooth, programs can be downloaded to the NXT-Brick without using the USB cable.



CAN YOU ANSWER THIS?

Fill in the blanks:

- 1)block is used to produce sound.
- 2) Volume for sound block which is by default set is at%.

Answers: 1) Sound 2)75

Multiple choice questions:

- 1) If check box for wait for completion is not checked, what will happen?
 - a) All sound from different sound blocks will get mixed.
 - b) The sound will keep on repeating
 - c) A and B
 - d) None of these

Disclaimer:

All rights reserved. This book or any portion thereof may not be reproduced or used in any manner whatsoever without the express written permission of **Cognite Intellectual Services** except for the use of brief quotations in a book review.

- 2) What are options present in the control option in the configuration panel of the sound block?
 a) Play b) Stop c) Play and Stop d) play or stop

Answers: 1) a 2) c

Answer the following Questions.

- 1) What should be done in configuration panel of the display block to erase the image?

Answer: Check the clear box.

- 2) What will be happened if the wait for completion box is unchecked?

Answer: Tone will continue to play with the next block of the program.

- 3) What is the name of the software used for programming?

Answer: NXT-G 2.1 Programming software.

- 4) What are the options present for making drawing using display block?

Answer: They are point, line and circle.

- 5) Which blocks are used to show any image for 5 seconds?

Answer: Display block and Wait for time block configured to 5 seconds.

- 6) How many sound blocks are required to produce 3 sounds?

Answer: Three

- 7) What are the different options which can be used to produce sound using sound block?

Answer: Sound file and Tone

Disclaimer:

All rights reserved. This book or any portion thereof may not be reproduced or used in any manner whatsoever without the express written permission of **Cognite Intellectual Services** except for the use of brief quotations in a book review.

CHAPTER-5

DISPLAY BLOCK (Display using NXT brick)

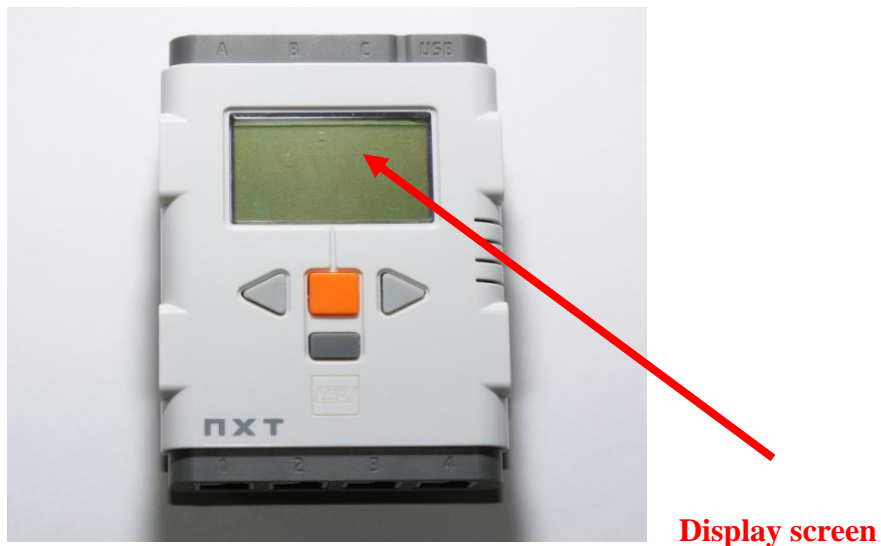


Fig 3.5 (i) NXT-Brick

LCD display can be used to show data which is configured in display block of NXT G. NXT Display Screen on the brick is used to show the current status of the brick or readings of the sensors or to display any text or symbol.

- Display block is used to write some text, draw any shape or display any image on the NXT screen.
- Several display blocks are used in a row to display complex drawings by adding text, shapes in different blocks.
- Check the 'clear' checkbox, to clear the screen before beginning.

Disclaimer:

All rights reserved. This book or any portion thereof may not be reproduced or used in any manner whatsoever without the express written permission of **Cognite Intellectual Services** except for the use of brief quotations in a book review.



CAN YOU ANSWER THIS?

Fill in the blanks:

- 1) The block which is used to show the text, image or drawing is called
- 2) It is necessary to check the checkbox of to erase the image.

Answers: 1) Display block 2) clear

Multiple choice questions

- 1) To display image on display screen, which option should be used?
 - a) Image b) Drawing c) Snail d) None of these
- 2) To display square on the display screen, which option should be used?
 - a) Image b) Drawing c) Snail d) None of these

Answers: 1) a 2) b

Answer the following questions:

- 1) How many display blocks are used to display a square?

Answer: Four

- 2) Which block is used to show text, image or drawing?

Answer: Display block

- 3) Name the type of palette which display block is present.

Answer: Common block

- 4) What should be done to erase the image which is shown in the previous display block?

Answer: Check the clear box

Disclaimer:

All rights reserved. This book or any portion thereof may not be reproduced or used in any manner whatsoever without the express written permission of **Cognite Intellectual Services** except for the use of brief quotations in a book review.

CHAPTER-6

MOVE BLOCK

Move Blocks are used to run or move motors. Motor play significant role in any robot as they perform all tasks which require any kind of controlled movement.

Configuring the move block

1. Select the motors that are to be controlled (Either A, B or C).
2. Choose whether the motors will go **forward**, **backward** or will be at **stop state**.
3. If two motors are used to drive a robot, the 'Steering slider' will appear with the chosen port letters indicated at each side for different types of turns.

The Move Block

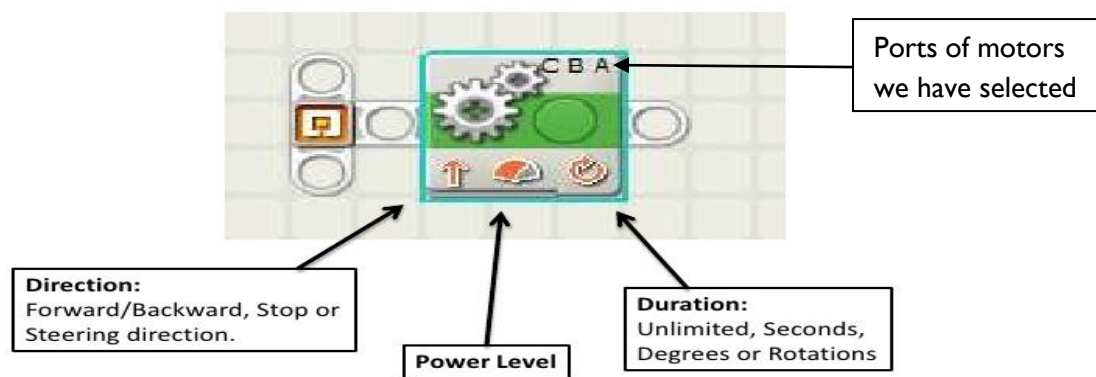


Fig 3.6 (i) Motor Block

4. The slider and the editable input box will help to set the power level [0-100%].
5. Using the Duration pull-down menu, the motors can be set to run for an **unlimited** interval or for a set number of **seconds**, **rotations** or **degrees**.
6. Choose whether the motors will break or coast after they finish their action. If the robot is supposed to stop precisely at an exact location, set the motors to brake.

Types of turns

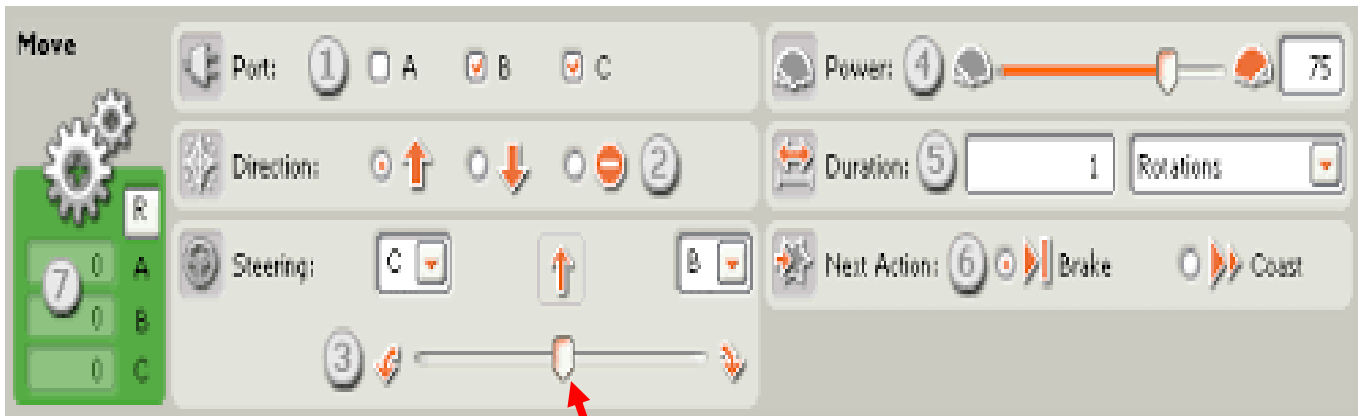
There are 3 types of turns which a LEGO NXT robot can take, they are:-

- **Swing turn:** A robot can be made to take a swing turn by just moving any one motor of a robot.

Disclaimer:

All rights reserved. This book or any portion thereof may not be reproduced or used in any manner whatsoever without the express written permission of **Cognite Intellectual Services** except for the use of brief quotations in a book review.

- **Point turn:** A robot can be made to take a point turn by moving the slider 1 notch from either end of the Steering slider bar. The robot can perform point turn when one motor moves in forward direction and second one in reverse direction.
- **Curve turn:** A robot can be made to take a curve turn by moving the slider to any location except the last 2 notches.



Slider

Fig 3.6 (ii) Configuration Panel of Motor Block

Disclaimer:

All rights reserved. This book or any portion thereof may not be reproduced or used in any manner whatsoever without the express written permission of **Cognite Intellectual Services** except for the use of brief quotations in a book review.



CAN YOU ANSWER THIS?

Fill in the blanks:

- 1) The first block of common palette is.....
- 2) The default power configuration of move block is at %
- 3) One rotation is equal todegrees.
- 4)turn is taken by moving only one motor at a time.
- 5) There aretypes of turn.
- 6) To stop the robot at the exact locationcan be set as next action option.

Answers: 1) Move 3) 360 5) three
 2)75 4) Swing 6) brake

Multiple Choice Questions:

- 1) For a robot to move for a particular duration, which option should be used?
 a. Unlimited b. Degrees c. Second d. Rotation
- 2) Which motor ports are selected by default?
 a. A b. B c. C d. B and C

Answers: 1) c 2) d

Answer the following questions:

- 1) What are the options present to set the direction?

Answer: Forward, Backward and stop.

- 2) How many degrees are required to turn the robot by 3 rotations?

Answer: 1 rotation = 360 degrees

Therefore, 3 rotations= 3X360 degrees = 1080 degrees

- 3) What steps should be taken to make a point turn?

Answer: A robot can be made to take a point turn by moving the slider 1 notch from either end of the Steering slider bar.

- 4) What steps should be taken by the robot to make a swing turn?

Answer: In swing turn, only one motor should be allowed to move in forward direction.

Disclaimer:

All rights reserved. This book or any portion thereof may not be reproduced or used in any manner whatsoever without the express written permission of **Cognite Intellectual Services** except for the use of brief quotations in a book review.

5) What steps should be taken by the robot to make a curve turn?

Answer: A robot can be made to take a curve turn by moving the slider to any location except the last 2 notches.

6) What are the programming steps to make a square path with the help of NXT software?

Answer: Programming steps for square path are:

- Move block port- BC, duration- degree measured
- Move block ,port B ,duration – degree
- Put all the blocks inside the loop.

7) What are the programming steps to make a circular path with the help of NXT software?

Answer: Programming steps for making a circular path are:

- Move block, port B , duration- unlimited, direction- forward
- Loop

Disclaimer:

All rights reserved. This book or any portion thereof may not be reproduced or used in any manner whatsoever without the express written permission of **Cognite Intellectual Services** except for the use of brief quotations in a book review.

UNIT-4

WAIT FOR BLOCK

Disclaimer:

*All rights reserved. This book or any portion thereof may not be reproduced or used in any manner whatsoever without the express written permission of **Cognite Intellectual Services** except for the use of brief quotations in a book review.*

CHAPTER-I

WAIT BLOCK

A wait block is a block that pause the program at its current point until its condition is met. These conditions can be either sensor based or value based. The robot will continue to perform specific task or pause until it receives something from a specific sensor. For Example In the case of a light sensor, it could be that it is waiting for a specific light value. The other option is a value. The values are either numeric or logic type. The wait block has many different icons because the image will change depending on what it is waiting for.

There are 5 different types of wait block:

- Wait for time
- Wait for touch sensor
- Wait for sound sensor
- Wait for light sensor
- Wait for distance

Wait for time

The wait for time carries task which is been performed before the wait block. The Wait for time block **does not** make the robot stop for some specific time. E.g. If any motors are at running state at the beginning of the block, they will keep running during the wait.. We can change the seconds in this block.

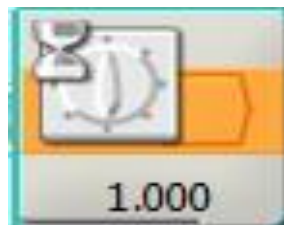


Fig 4.1 (i) WAIT FOR TIME BLOCK(Wait for 1sec)

Disclaimer:

*All rights reserved. This book or any portion thereof may not be reproduced or used in any manner whatsoever without the express written permission of **Cognite Intellectual Services** except for the use of brief quotations in a book review.*

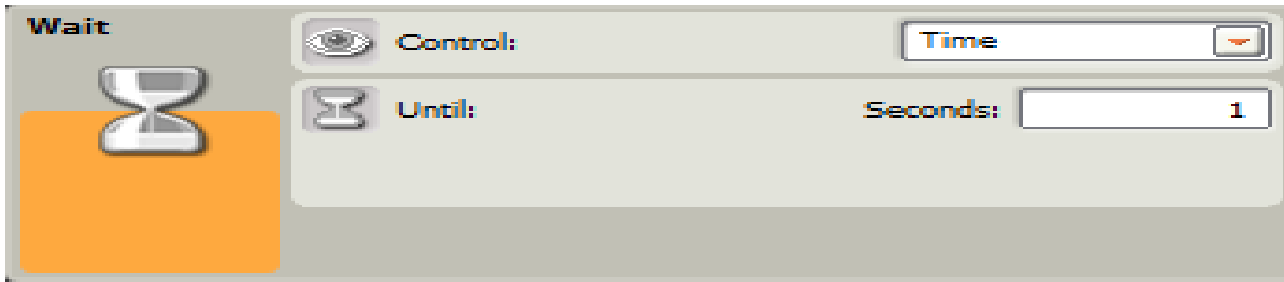


Fig 4.1 (ii) Configuration panel of wait for time block

Wait for touch block

In this block the robot waits for condition until touch sensor is pressed, released or bumped. As soon as the touch sensor is pressed or released or bumped it will execute the instructions that are present just after the wait for touch block. An example of this:

A robot is driving forward on infinite. The robot stops when its Touch Sensor is pressed against an object.

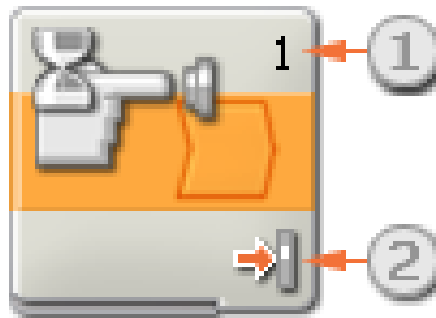


Fig 4.1 (iii) Wait for Touch Block

- 1 shows the port number which the block is monitored to.
- 2 show the condition whether pressed, released or bumped.

Wait for sound block

Wait for sound block waits for the sound sensor to detect the condition set for the sensor (either sound more than 50 or less than 50).

Use a Sound Sensor Wait Block to program the robot to "wait" for a Sound Sensor to detect a certain intensity or sound before going on to the next block in the program. An example of this:

- i. A robot is driving forward on infinite.
- ii. The robot stops when sound Sensor detects an intensity of sound more than 50.

Disclaimer:

*All rights reserved. This book or any portion thereof may not be reproduced or used in any manner whatsoever without the express written permission of **Cognite Intellectual Services** except for the use of brief quotations in a book review.*

Choose “Sound Sensor” and program will wait for the sound sensor to be activated by a certain intensity of sound.

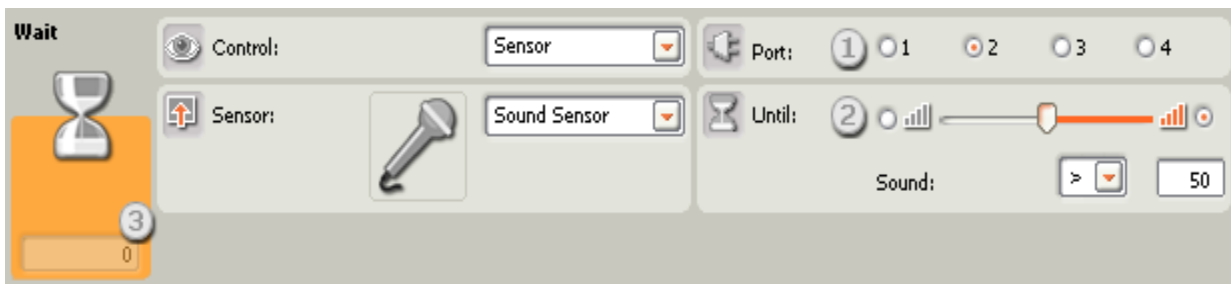


Fig4.1 (iv) Configuration Panel of Sound Block

1. Choose the port where sound sensor is plugged in. By default, the block will be set to Port2 for a sound sensor.
2. Use the slider to set the trigger value or type a value into the input box. Select the radio button to the right of the slider if the block has to be triggered by sound levels higher than the trigger value; select the left radio button to trigger the block with sound levels lower than the trigger value. Also use the pull-down menu to set the “true” portion of the slider.
 1. The feedback box displays the current sound reading (0-100%). Also use it for trying out different trigger values.

Wait for light block

Wait for light block waits for the light sensor to detect the condition set for the sensor (either intensity of light more than 50 or less than 50).



Fig 4.1 (v) Wait for Light Block

Disclaimer:

*All rights reserved. This book or any portion thereof may not be reproduced or used in any manner whatsoever without the express written permission of **Cognite Intellectual Services** except for the use of brief quotations in a book review.*

Wait for distance block

Wait for distance block waits for the ultra-sonic sensor to check the condition of the distance mentioned. Distance can be in inches or centimeter.

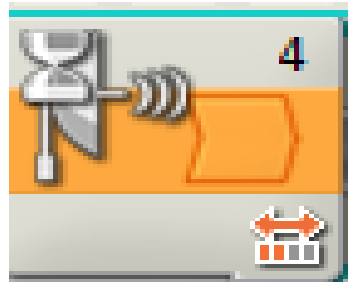


Fig 4.1 (vi) Wait for Distance Block

Disclaimer:

All rights reserved. This book or any portion thereof may not be reproduced or used in any manner whatsoever without the express written permission of **Cognite Intellectual Services** except for the use of brief quotations in a book review.

CHAPTER-2

WAIT FOR TOUCH BLOCK



Fig4.2(i) Touch Sensor

Electrical Circuit

1. When the touch sensor is not pressed, the circuit is incomplete.

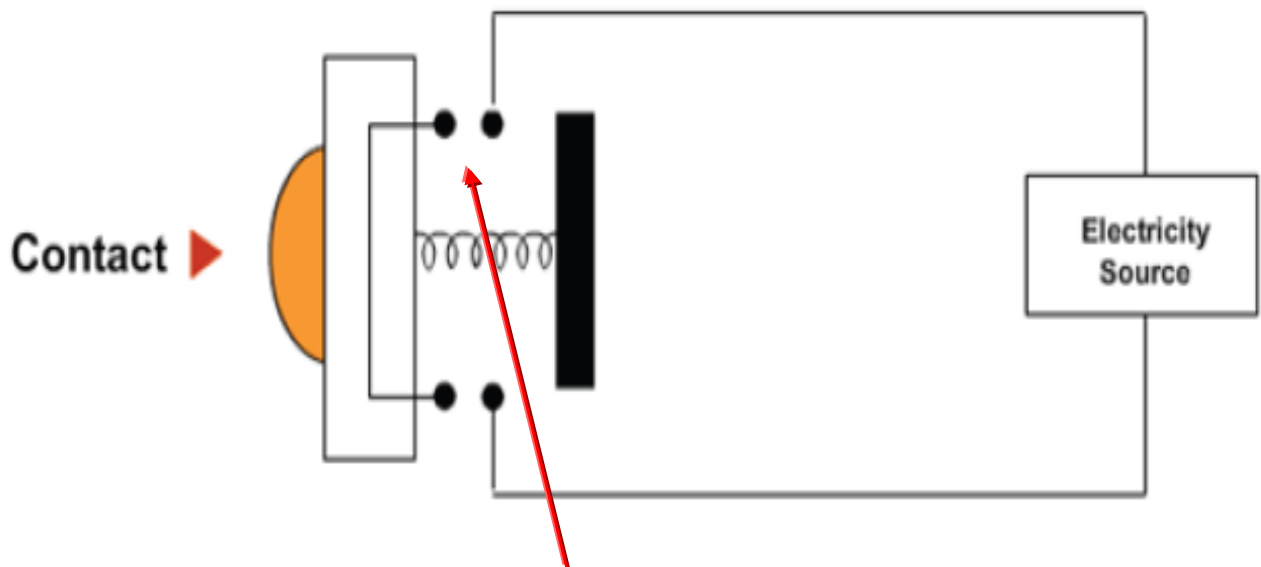


Fig4.2(ii) Open Circuit

Disclaimer:

All rights reserved. This book or any portion thereof may not be reproduced or used in any manner whatsoever without the express written permission of **Cognite Intellectual Services** except for the use of brief quotations in a book review.

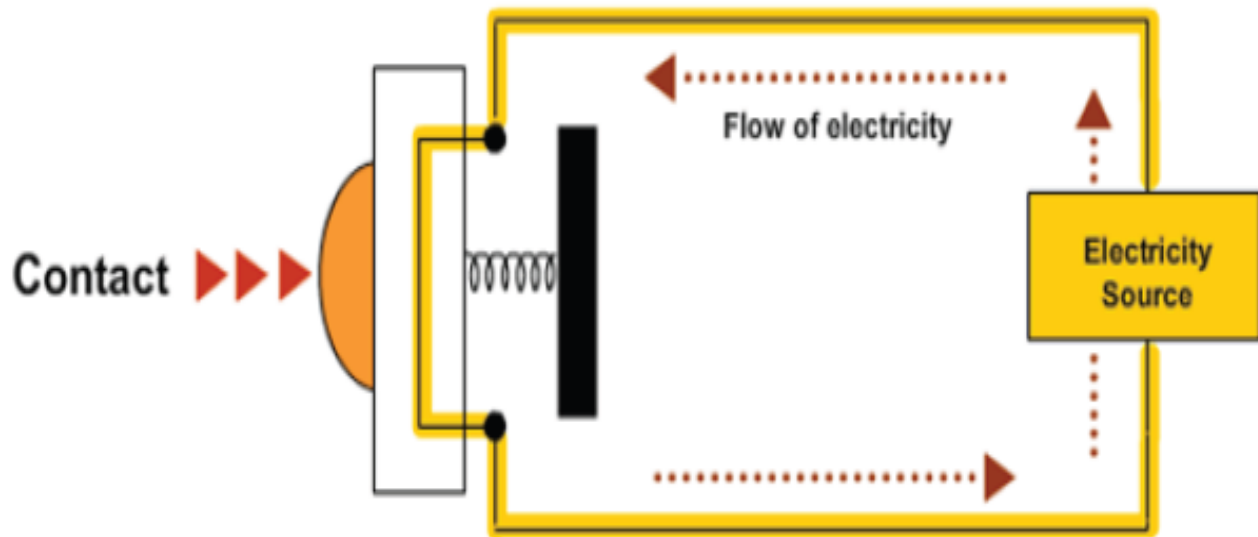


Fig4.2(iii) Closed Circuit (electricity starts flowing).

Configuring the touch sensor

- Choose the port in which the Touch Sensor is connected to. By default, the block will always be set at Port 1 for a Touch Sensor.
- Radio buttons will be used to specify for which condition the Touch Sensor is to be bumped, pressed or released to let the program continue. By default, always Pressed is selected.
- ‘Bumped’ will be chosen if the block has to be triggered after a quick press and release of the Touch Sensor.
‘Pressed’ should be selected if the block to be triggered at the instant the Touch Sensor is pressed in and ‘Released’ if block to be triggered at the instant the Touch Sensor is released.

Disclaimer:

*All rights reserved. This book or any portion thereof may not be reproduced or used in any manner whatsoever without the express written permission of **Cognite Intellectual Services** except for the use of brief quotations in a book review.*

TASK

Design a Bumper-bot with proper programming steps. Bumper robot is a robot which has 2 touch sensors one facing forward and one facing backward. It moves forward until the front sensor gets pressed after that it starts moving backward again until the 2nd sensor gets pressed and it keeps on repeating this forever.



- Move block, direction forward, duration unlimited, port b and c.
- Wait for touch block, condition pressed, port 1.
- Move block, direction backward, duration unlimited, port b and c.
- Wait for touch block, condition pressed, port 2.

TASK

Design a manual controlled tri-bot which has 2 touch sensors each one will controls each side of motor. It should move forward when both the touch sensors are in pressed condition, stop when both are in released condition, turn right when only left sensor has been pressed and turn left when right sensor has been pressed.



The above bot is known as **TOUCH-BOT**.

Switch block - touch sensor - pressed condition, port 1

1. in true condition

(a). Switch block - touch sensor - pressed condition, port 4

(a) In true condition

Disclaimer:

*All rights reserved. This book or any portion thereof may not be reproduced or used in any manner whatsoever without the express written permission of **Cognite Intellectual Services** except for the use of brief quotations in a book review.*

Move block - direction forward - port b and c - duration unlimited

(a) In false condition

Move block - direction forward - port b, duration unlimited

Move block - stop - port c

2. in false condition

(b). Switch block - touch sensor - pressed condition, port 4

(b) In true condition

Move block - direction forward - port c, duration unlimited

Move block - stop - port b

(b) In false condition

Move block - stop - port b and c



Trigger Your Brain?

If we want to reverse the working of the motors i.e. when the right Touch Sensor is pressed, the left motor should move and vice-versa. What will be changes in the programming steps?

.....
.....
.....
.....
.....

Disclaimer:

*All rights reserved. This book or any portion thereof may not be reproduced or used in any manner whatsoever without the express written permission of **Cognite Intellectual Services** except for the use of brief quotations in a book review.*



CAN YOU ANSWER THIS?

Fill in the blanks:

- 1) The sensor which is used by robot as its skin is called.....
- 2) The robot will wait until the touch sensor is pressed with the help of.....
- 3) The robot which will move in to and fro motion on touching is called.....

Answers: 1) Touch sensor 2) Wait for touch 3) Bumper robot

Multiple choice questions:

- 1) In bumper robot in which ports the touch sensor is connected?
 - a) 1 and 2
 - b) 1 and 3
 - c) 1 and 4
 - d) All the options given
- 2) What is the initial state of the touch sensor?
 - a) Pressed
 - b) Released
 - c) Bumped
 - d) none of these

Answers: 1) d 2) b

Answer the following questions:

- 1) What is Wait for touch block?

Answer: The block which makes the program pause until touch sensor is pressed, released or bumped.

- 2) Write the programming steps for BUMPER ROBOT.

Answer: Programming steps for BUMPER ROBOT are:

- Move block, ports BC, duration - unlimited, direction – forward
- Wait for touch, Port 1, pressed
- Move block, port BC, duration- unlimited
- Wait for touch ,port 2, pressed
- Put all these blocks inside the **loop**.

- 3) What is touch bot?

Disclaimer:

All rights reserved. This book or any portion thereof may not be reproduced or used in any manner whatsoever without the express written permission of **Cognite Intellectual Services** except for the use of brief quotations in a book review.

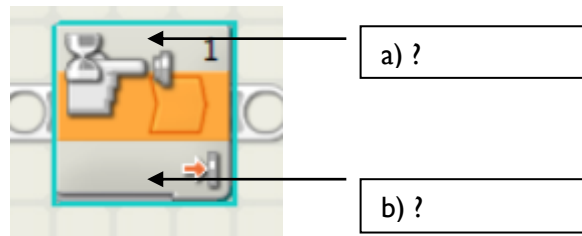
Answer: Touch bot is a manually controlled robot. In this robot the left touch sensor will control the left motor and the right touch sensor will control the right motor.

4) Write the programming steps for touch bot.

Answer: Programming steps for TOUCH BOT are

- Switch block configure to touch sensor, port 1, state- pressed
 - True part Switch Block configure to touch sensor, port 2, state – pressed
 - True part: Move Block, Port BC, duration –Unlimited, Direction –Forward.
 - False part: Move Block, Port B, duration – unlimited, direction- Forward.
- False part switch block configure to touch sensor, port 2, state – pressed
 - True part: move block; port C, duration –unlimited, direction –Forward.
 - False part: move block, port BC, duration – stop.

5) Write the names of the points given in the following block



Answer: a) Port number

b) State of the touch sensor

Disclaimer:

All rights reserved. This book or any portion thereof may not be reproduced or used in any manner whatsoever without the express written permission of **Cognite Intellectual Services** except for the use of brief quotations in a book review.

CHAPTER-3

WAIT FOR DISTANCE BLOCK

Ultrasonic sensor:-

The Ultrasonic Sensor enables the robot to see and recognize objects, avoid obstacles, measure distances, and detect movement. The Ultrasonic Sensor measures distance in centimeters and inches. It is able to measure distances from 0 to 2.5 meters with a precision of +/-3 cms.



Fig4.3 (i) Image of Ultra-Sonic Sensor

Working Principle:

- The Ultrasonic Sensor measures distance by calculating the time taken by an ultrasonic wave sent out by the emitter to bounce off an object and come back to the receiver.
- The Sensor has two openings on its front; one emits ultrasonic waves, while the other receives them.
- The Ultrasonic Sensor measures distance in centimeters and inches.

Steps to configure an ultrasonic sensor:

- Take a “wait for distance” block from common palette.
- If the radio button to the left of the slider is chosen, the block will be triggered when it detects an object that is closer than the trigger distance; select the right radio button to trigger the block when it detects an object farther away than the trigger distance.
- In configuration panel select the unit (i.e. centimeter or inch) first according to the condition.
- Use the slider to set the trigger distance or type a value directly into the input box (0-250 if configured for centimeters or 0-100 if configured for inches).



Design a shy-bot. Shybot is a robot which has an ultrasonic sensor. It moves forward and as soon as it detects anything it moves back with full speed and changes its direction.

Disclaimer:

*All rights reserved. This book or any portion thereof may not be reproduced or used in any manner whatsoever without the express written permission of **Cognite Intellectual Services** except for the use of brief quotations in a book review.*



- Move block, unlimited, forward, port b and c
 - Wait for distance, distance < 15 cm
 - Move block, backward, duration 2 rotation, port b and c, speed 100
 - Move block, forward, duration 500 degrees, port b
 - Loop block, forever, all blocks inside.
-



Design a table-top bot. Tabletop robot is a robot which has an ultrasonic sensor attached facing down. It can move on the edgeless tables without falling off from the table.



- Move block, unlimited, forward, port b and c
- Wait for distance, distance > 15 cm
- Move block, stop, port b and c
- Move block, backward, duration 2 rotation, port b and c
- Move block, forward, duration 500 degrees, port b
- Loop block, forever, all blocks inside.

Disclaimer:

*All rights reserved. This book or any portion thereof may not be reproduced or used in any manner whatsoever without the express written permission of **Cognite Intellectual Services** except for the use of brief quotations in a book review.*



CAN YOU ANSWER THIS?

Answer the following questions:

I. What is the function of Ultrasonic sensor?

Answer: Ultrasonic sensor can measure the distance and detects the obstacle. The default port for ultrasonic sensor is 4.

II. What is the working principle of ultrasonic sensor?

Answer: Ultrasonic sensor has emitter and receiver. Emitter emits the ultrasonic sound waves and then it is received by the receiver after getting reflected back by the object.

3) One real-life example of working principle of ultrasonic sensor in surroundings?

Answer: Bats use the working principle of ultrasonic sensor for calculating the distance in night.

4) What is SHYBOT?

Answer: Shybot is a robot which has an ultrasonic sensor. It moves forward, as soon as it detect anything it moves back with full speed and changes it's direction.

5) Write the programming steps of SHYBOT.

Answer: Programming steps for SHYBOT are

- Move block, port BC, duration- unlimited, direction- Forward
- Wait for distance block, Duration- less than 20cm
- Move block ,Port BC, duration- 2 rotation ,direction – Backward ,Power -100%
- Move block ,Port B ,Duration – 1 rotation
- Put all these block in the **Loop**.

6) What is TABLE TOP robot?

Answer: Tabletop robot is a robot which has an ultrasonic sensor attached facing down. It can move on the edge less tables without falling off from the table.

7) Write the programming steps for Table Top Robot.

Answer: Programming steps for TABLE TOP ROBOT are

- Move block , port BC ,Duration – unlimited, direction – Forward

Disclaimer:

All rights reserved. This book or any portion thereof may not be reproduced or used in any manner whatsoever without the express written permission of **Cognite Intellectual Services** except for the use of brief quotations in a book review.

- Wait for distance , duration – greater than distance calculated (between the ultrasonic sensor and the surface)
- Move block ,Port BC , duration – 1 rotation , direction – Backward
- Move block ,Port B, Duration – 1 rotation , direction – Forward.

Fill in the blanks:

- 1) The unit of distance measured by the ultrasonic sensor are and
- 2) The sensor which is used to avoid obstacle is
- 3) The ultrasonic waves are received by
- 4) The sensor which is used by robot as its skin is called.....
- 5) Sensors are connected to brick with the help of
- 6) The robot will wait until the touch sensor is pressed with the help of.....

Answers: 1) cm, inches

2) ultrasonic sensor

3) receiver

4) Touch sensor

5) wires

6) wait for touch

Disclaimer:

*All rights reserved. This book or any portion thereof may not be reproduced or used in any manner whatsoever without the express written permission of **Cognite Intellectual Services** except for the use of brief quotations in a book review.*