**Virtual Initio Programming: Data Structure Exercises**



**AIM:** This exercise sheet provides additional programs using lists and dictionaries. It assumes familiarity with worksheets 19-21.

You may want to use **square.xml** or **line\_following.xml** as the world for these exercises.

**Exercise 1**: Use a dictionary to create a set of rewards where the key is the value returned by the infra-red left line sensor and the reward is 1 if the sensor detects black and 0 otherwise. Write a program that will execute a random action and then print out the reward after the action has executed for 3 seconds.

**Exercise 2**: Create a dictionary of scores for each action. Modify your previous program so that the reward for an action gets added to its score. After 20 random actions the program prints out the total reward for each action.

**Exercise 3:** Adapt your program so that the reward dictionary keys are now lists. Each list is a pair of the value from the left line sensor and the right line sensor and the reward is 2 if both sensors detect black, 1 if 1 sensor detects black and 0 otherwise.

**Exercise 4:** Adapt your program again so that the total reward score for an action is divided by the number of times that action has been taken – to give an average reward for each action.

**Hint:** You will probably need to create another dictionary to keep track of how many times each action has been taken.

**Hint:** Depending upon your implementation you may also want to watch out for division by zero which will give an error.



 University of Liverpool, 2019

This work is licensed under a [Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International License](https://creativecommons.org/licenses/by-nc-sa/4.0/).