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Keywords—component, formatting, style, styling, insert (key words)

# Introduction (*Heading 1*)

This template, modified in MS Word 2007 and saved as a “Word 97-2003 Document” for the PC, provides authors with most of the formatting specifications needed for preparing electronic versions of their papers. All standard paper components have been specified for three reasons: (1) ease of use when formatting individual papers, (2) automatic compliance to electronic requirements that facilitate the concurrent or later production of electronic products, and (3) conformity of style throughout a conference proceedings. Margins, column widths, line spacing, and type styles are built-in; examples of the type styles are provided throughout this document and are identified in italic type, within parentheses, following the example. Some components, such as multi-leveled equations, graphics, and tables are not prescribed, although the various table text styles are provided. The formatter will need to create these components, incorporating the applicable criteria that follow.

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# coding

We have 4 different tasks that we need to solve. Each task has different maps and different condition to fulfill. Our main purpose throughout this project is that our ResQ robot (R)would be able to reach the target whether the target is on the water(t) or on land mode(T). To reach the target, the robot must be able to destroy obstacles (\*), avoid from hitting the walls(#) and changing the mode. For example, by changing the mode from water mode to land mode. In order to fulfill the task requirement, we have decided to use the Breadth First Search algorithm (BFS).

## Breadth First Search Algorithm

Breadth first search is an algorithm for finding shortest path to reach the target or solve puzzle. BFS works best when there is a concept of layers or levels of neighborhoods in the graph we are dealing with. The BFS algorithm starts from a root vertex and explores the vertices in the neighborhood vertices. It then moves to the next neighborhood level and repeats the process [2]. For breadth-first search (BFS), the set Open is realized as a first-in first-out queue (FIFO). The Insert operation is called Enqueue and adds an element to the end of the list; the Dequeue operation selects and removes its first element. As a result, the neighbors of the source node are generated layer by layer (one edge apart, two edges apart, and so on) then, BFS stops as soon as it generates the goal [1].

### Initialization

We will use two data structures:

* visited: This contains all the vertices that have been visited. Initially, it will be empty [2].
* queue: This contains all the vertices that we have want to visit in next iterations [2].

### The main loop

### 

Next, we will implement the main loop. It will keep on looping until there is not even a single element in the queue. For each node in the queue, if it has already been visited, then it visits its neighbor [2].

## Task 1

At the beginning, we only need to move the robot to find target without any obstacles. The robot only requires avoiding from hitting the walls (#) and reach the target which located on land. In this part, we only have one map that need to be tested. The map is shown in figure 1.

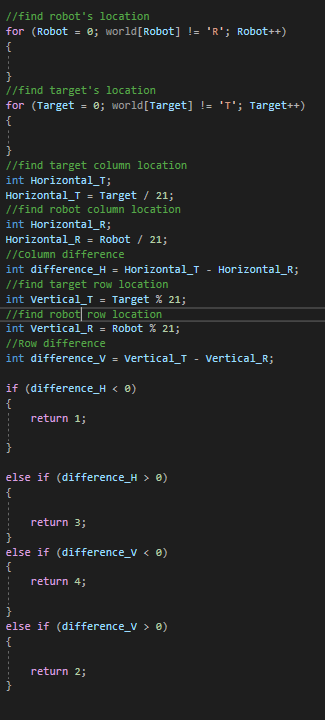
1. Map for task 1.

### Pseudocode

* Find robot position.
* Find target position.
* Find row and column of robot in the map.
* Find row and column of target in the map.
* Find column difference between robot and target.
* Find row difference between robot and target.
* If column difference greater than 0, move south.
* If column difference less than 0, move north.
* If row difference greater than 0, move east.
* If row difference less than 0, move west.

### Code

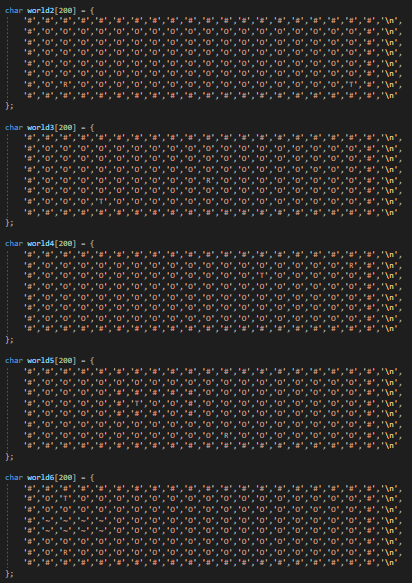
Based on pseudocode, we implement the code as shown in figure 2.



1. Code for task 1

## Task 2

Now the task is quite challenging as the walls are located randomly, not just on the border. The maps are shown in figure 3. Furthermore, robot will be able to move both on water and on land by changing its mode either land mode or water mode. To reach the target without any crash or failure, the robot requires to find the shortest path to the target by avoiding the walls and switch the mode correctly.



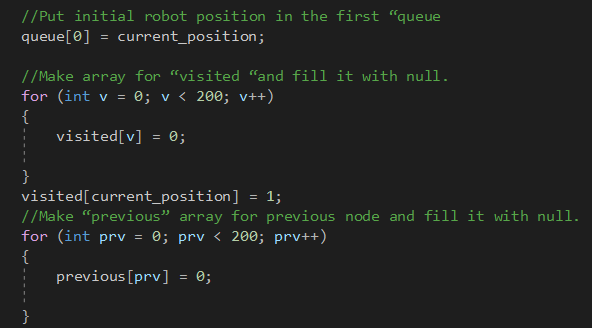
1. Maps for task 2

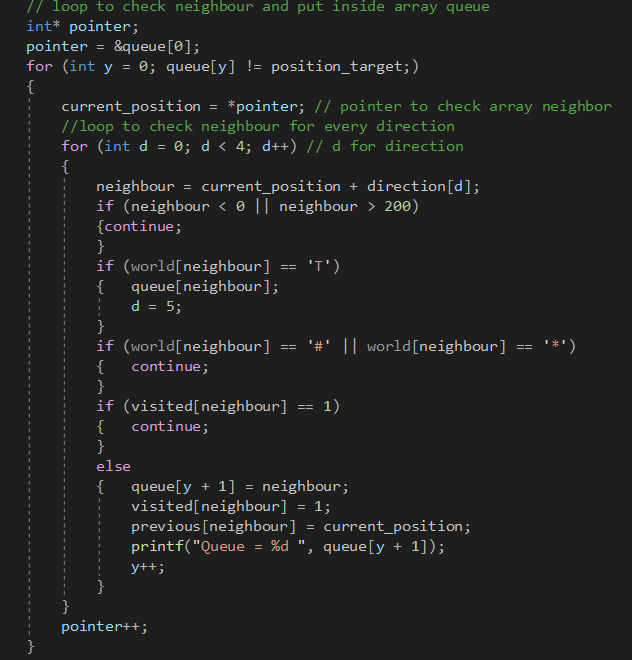
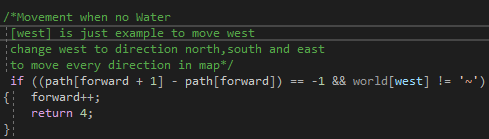
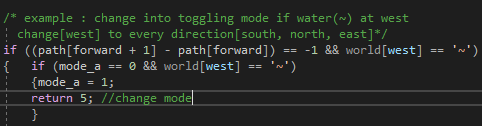
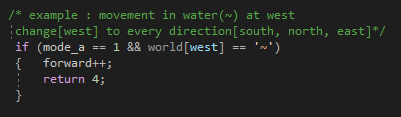
### Pseudocode

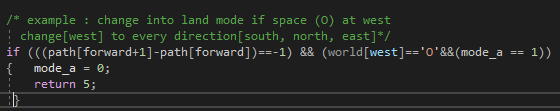
* Find target and robot position.
* Make array for “queue”.
* Put initial robot position in the first “queue”.
* Make array for “visited “and fill it with null.
* Mark current robot position as visited.
* Make “previous” array for previous node and fill it with null.
* Make loop to check neighbor of nodes until target is found.
* If neighbor nodes is not wall and obstacle (for task 3), then put node in “queue” array.
* Mark the node as visited from avoiding checking the same node.
* Keep track of node in array “previous”.
* Call “previous” array to construct reverse path (from target to robot).
* Use reverse path to construct correct path (from robot to target).
* If there is water in path, change the robot mode from land to water mode.
* Move robot to target according to the correct path.

### Code

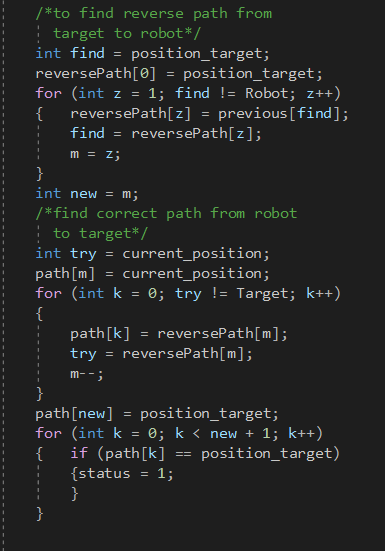
Based on pseudocode, we implement the code as shown in figure 2.



1. Construct visited array and previous node array.
2. Fill up queue array and check neighbor.
3. Array for reverse path and correct path
4. Movement of robot on land in west direction   
   as example.
5. Change mode from water mode to   
   land mode (west as example)
6. Movement of robot in water in direction west as example.

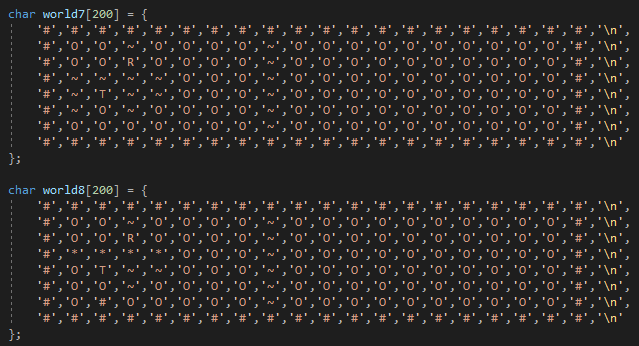


1. Change back water mode to land mode (west as example)



## Task 3

After finding the shortest path in task 2, our robot can manage to return to its original position where it is located at first for task 3. Instead of only to keep away from hitting the walls, robot has included with new features which is avoiding the obstacles (\*) and use less energy. In this task also, we have extra two maps as shown in figure…

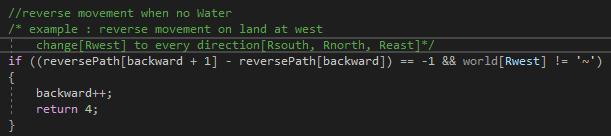


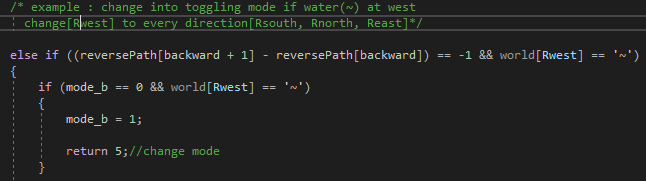
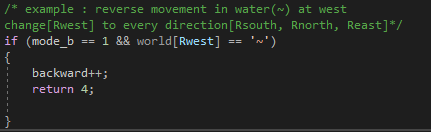
1. Maps for task 3

### Pseudocode

* For the first step, follow pseudocode task 2.
* Move the robot back to its initial position using reverse path.
* If in reverse path has water or land, then change robot mode from land mode to water mode and vice versa.

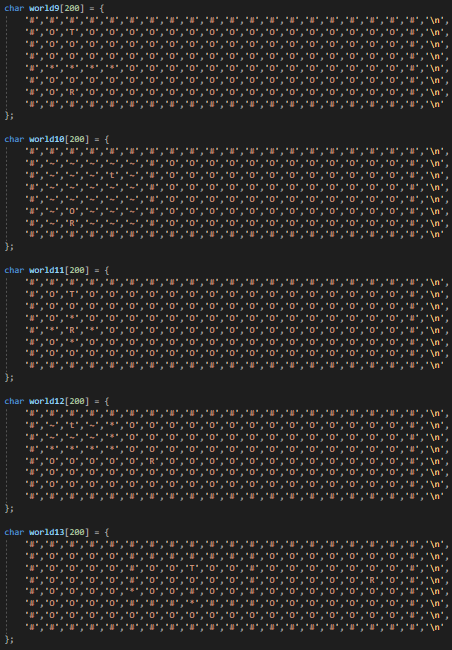
### Code



1. Reverse movement of robot on land in west direction   
   as example
2. Change mode from water mode to   
   land mode (west as example) in reverse path.
3. Reverse movement of robot in water in direction west as example.
4. Change back water mode to land mode (west as example) in reverse path.

## Task 4

For this task, the target is located not only on land(T) but also on water(t). As task 3, the robot is assigned to avoid obstacles but, in this task, the robot can destroy the obstacles in any direction which is North, South, West and East in order to reach the target faster.

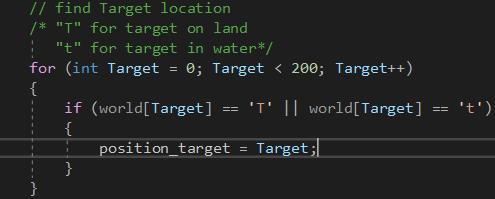


1. Maps for task 4

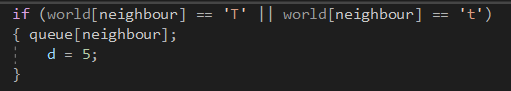
### Pseudocode

* For the first step, follow pseudocode task 2, but consider obstacles to put in the “queue” array.
* If in correct path, there is obstacles, then robot will destroy obstacles.
* Move the robot back to its initial position using reverse path.
* If in reverse path has water or land, then change robot mode from land mode to water mode and vice versa.

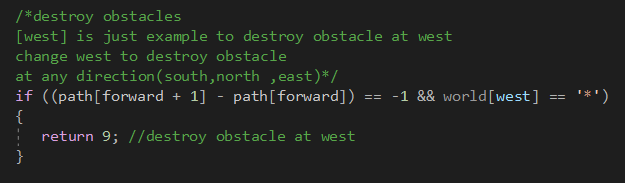
### Code



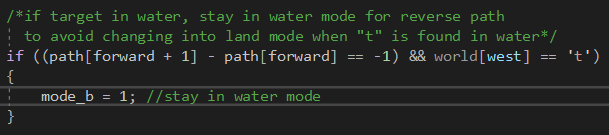
1. “t” is included for task 4 as target.



1. “t” is added to fill up queue array and check neighbor.



1. Destroy obstacle at west as example.



1. Stay in water mode when “t” is found.

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1. Table Type Styles

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| --- | --- | --- | --- |
| Table column subhead | Subhead | Subhead |
| copy | More table copya |  |  |

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3. . S. Jacobs and C. P. Bean, “Fine particles, thin films and exchange anisotropy,” in Magnetism, vol. III, G. T. Rado and H. Suhl, Eds. New York: Academic, 1963, pp. 271–350.
4. K. Elissa, “Title of paper if known,” unpublished.
5. R. Nicole, “Title of paper with only first word capitalized,” J. Name Stand. Abbrev., in press.
6. Y. Yorozu, M. Hirano, K. Oka, and Y. Tagawa, “Electron spectroscopy studies on magneto-optical media and plastic substrate interface,” IEEE Transl. J. Magn. Japan, vol. 2, pp. 740–741, August 1987 [Digests 9th Annual Conf. Magnetics Japan, p. 301, 1982].
7. M. Young, The Technical Writer’s Handbook. Mill Valley, CA: University Science, 1989.

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