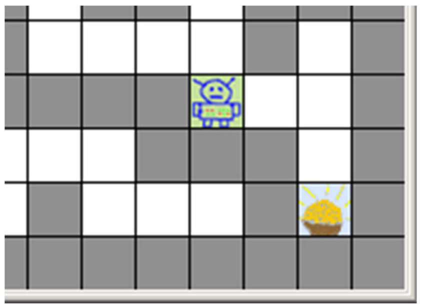
ECE 118 LAB TWELVE

This is a continuation of lab eleven. Remind yourself of the assignment for that lab, and the instructions that came with it, and carry on here.

7. *Better Graphics*

There are two useful library functions that will display graphics from image files. You should have proper pictures of the robot and the treasure. You can even have nicer backgrounds for the maze squares if you want:



One function is called `image_from_file()`. It takes as its one parameter the name of a file, which may be any `.gif`, `.png`, or `.bmp` file, and extracts the image data from it. It returns a strange value whose type in C++ is "`image *`". But beware:
It looks as though a new version of the gif format has appeared since I made the gif-handling function. If you have trouble opening a gif image, got for bmp instead, that hasn't changed. There are plenty of free on-line tools for converting between image formats.

The second function is called `draw_image`. It takes three parameters: one of those "`image *`" things I just mentioned, and two `int`s that specify the x and y coordinates of the position in the window where the image should be drawn (top left corner).

It is a very simple process. When the program is first started, it might have a statement or two that look something like this:

```
image * robot_icon = image_from_file("robot.gif");
image * gold_icon = image_from_file("c:/progs/lab12/gold.bmp");
```

and later, when it is time to draw the robot, you would simply write

```
draw_image(robot_icon, x, y);
```

where of course `x` and `y` are replaced by the appropriate position coordinates.

8. *Retracing Steps*

In order to avoid getting lost, it is important for explorers to remember the path they followed, so that they can always reliably retrace their steps. Just like the Apollo Eleven astronauts who left a trail of breadcrumbs behind them so they could find their way back home from the Moon.

Give your explorer this ability. The easiest way is to create a second array, the same size as the maze map array. Every time the robot explorer moves into a square, how it got there (which direction it moved in) is stored in the corresponding position in the second array. If ever the robot needs to go back, it just looks in the new array to see what direction it came in, and moves in the opposite direction.

Add a '`B`' command (for Back) to your program. Each time '`B`' is typed, the robot should retrace his/her steps by one square. If you keep typing '`B`', it should eventually get all the way back to its starting position. Of course it won't work if you've gone in a circle. Important: the *how-I-got-here* array should only be updated after normal movements, not after '`B`' commands. Otherwise two '`B`'s in a row will have no overall effect.

9. *Semi-Intelligent Behaviour*

It is fairly easy to make your robot explore the maze totally unaided, and find a path to the treasure (if a path exists). This is the strategy:

- Whenever the robot finds itself anywhere in the maze, it should examine each of the four neighbouring squares. If there is any neighbouring non-wall square that it has never been in before, it should move into it.
- If there is more than one unexplored neighbouring square, just pick any one.
- If ever the robot finds there are no neighbouring squares that it has never visited before, then it should retrace its steps by one square, and continue the procedure from there.
- If ever the robot finds itself at the treasure square, it has solved the maze, and should stop and be happy.
- If ever the robot finds itself trying to retrace its steps back from the starting square, that means that the maze has no solution, and it would probably go on a rampage.

Automate your robot, so that it follows this strategy whenever you put it in automatic mode (you can make up your own strategy if you like, but it won't be easy to find another one that always works) and finds its way from '`+`' to '`$`' without any help.

This strategy is what makes this a reasonable robotics experiment. Even though the program has posession of a complete map of the maze, it doesn't cheat by using it too much. At every step it only considers the immediately neighbouring squares when deciding what to do next, working under the same restrictions as a real robot lost in a maze, only having the information that its own sensors can gather.

10. *The Yellow Brick Road*

Once the robot successfully reaches the treasure square, it would be nice to make the whole path it took clearly visible, perhaps by colouring those squares in a way that stands out. Of course, we would only want to see the squares it visited that were on the successful path, not ones that it later backed out of by retracing its steps.

The information required to do this very easily is already recorded in your program. Try to work out what to do, and then do it.

11. *Monsters*

Put a monster at a random position in the maze. Every time the robot makes a move, the monster also makes a move, heading toward the robot's position one square at a time, not being allowed to walk through walls of course. If the monster reaches the robot, you can decide what happens.

To make it more of an interesting game, you could make the monster move at its own pace instead of just taking turns. You could perhaps have the monster move one square every second, regardless of what your robot has done.

I expect this would be more interesting to have the monster(s) move even when the robot is not in automatic mode, then people could play properly. Remember that the key-press detecting function can be given a minimum wait time. It would not be reasonable if the monsters could only move taking turns with the human player.

You could have different monsters with different degrees of intelligence: the dimmest ones could just move at random, cleverer ones could rush for the treasure and try to ambush your robot on the way. You can think up other monster plans too.

You probably have a better idea of what makes a good video game than I have, so just get on with it. Make it good. Try to make it into something that a person could enjoy playing with for a little while.