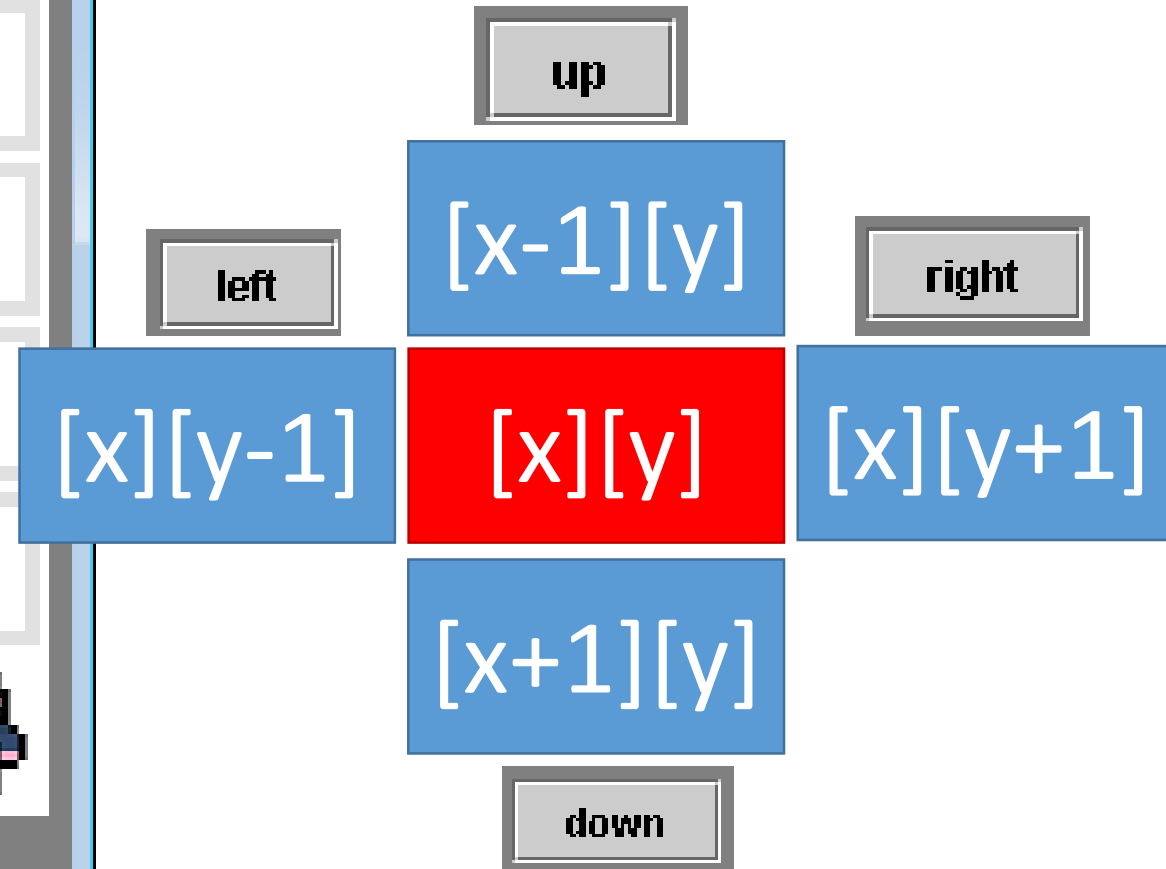
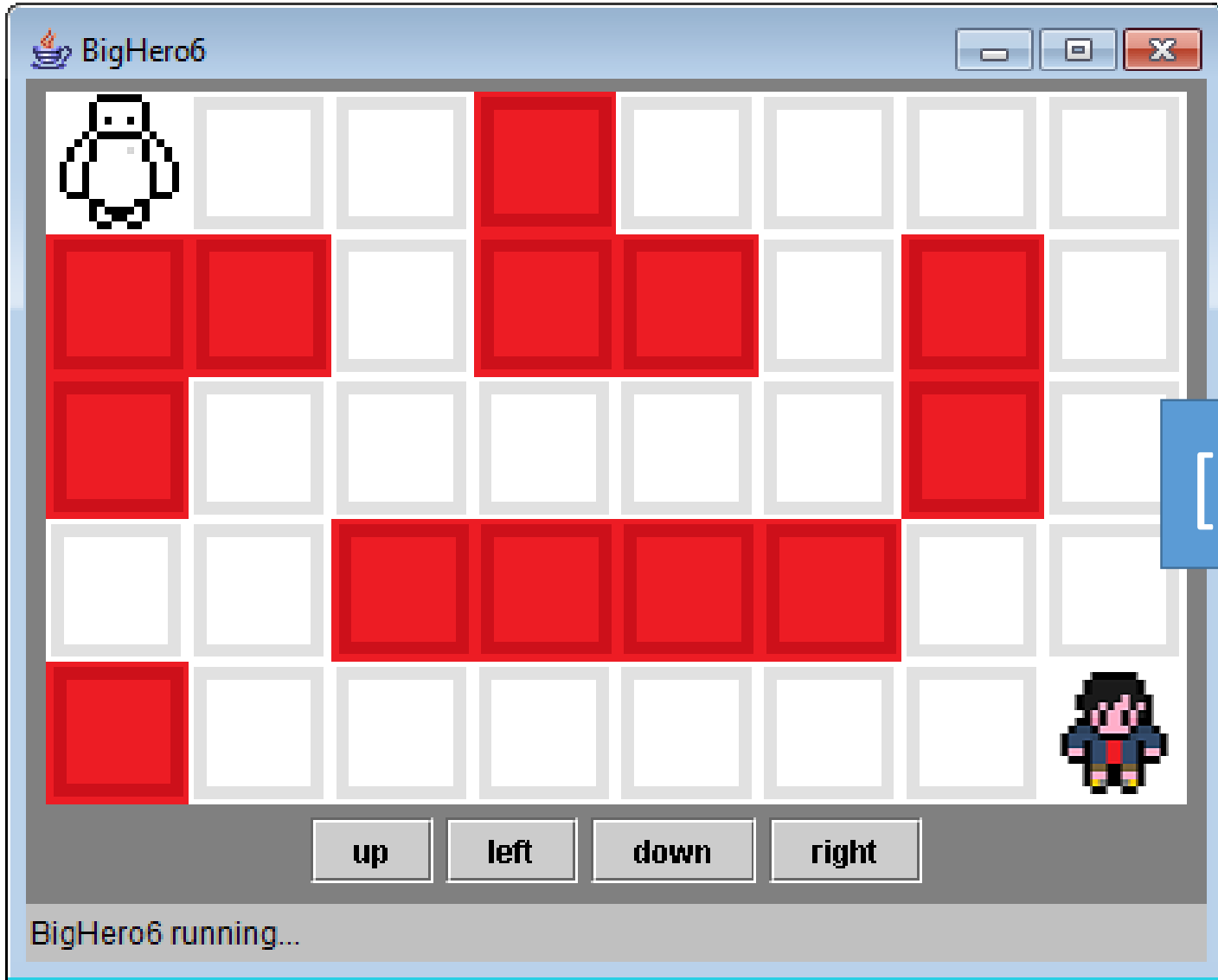


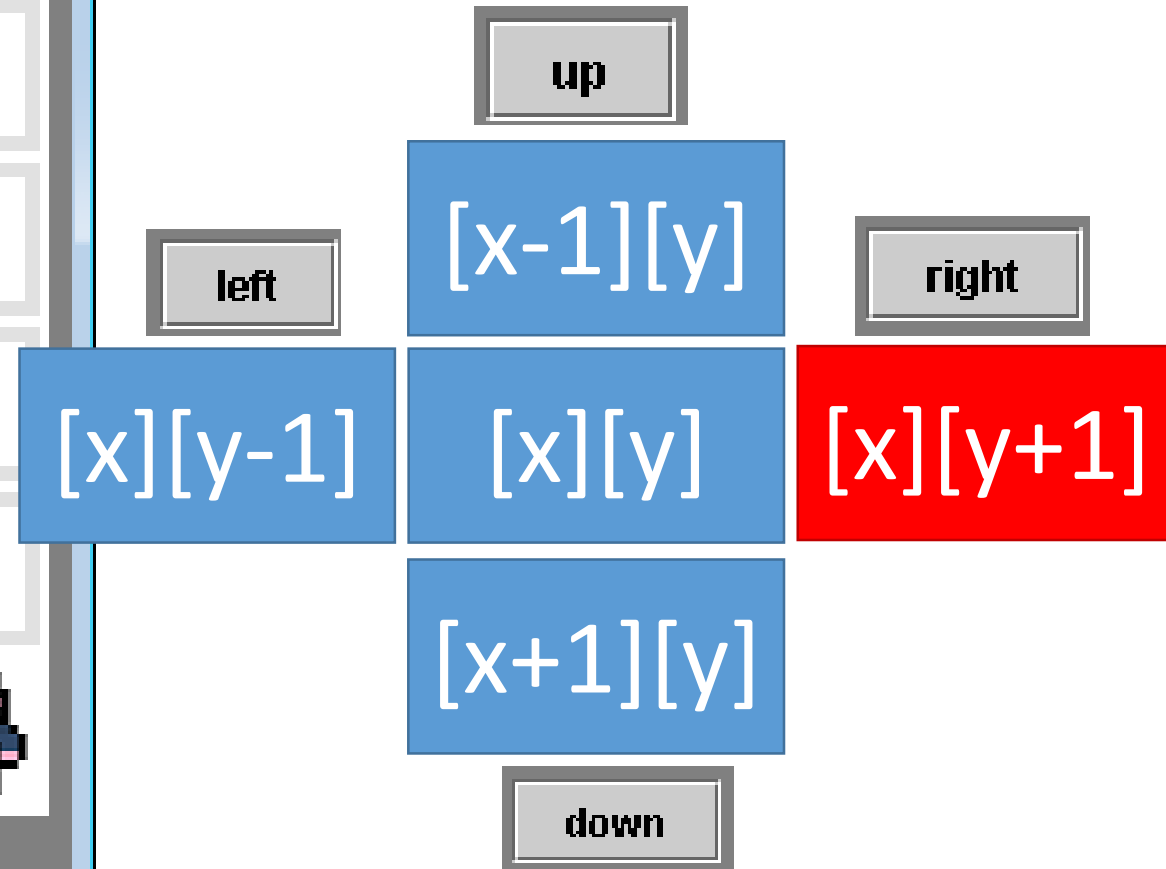
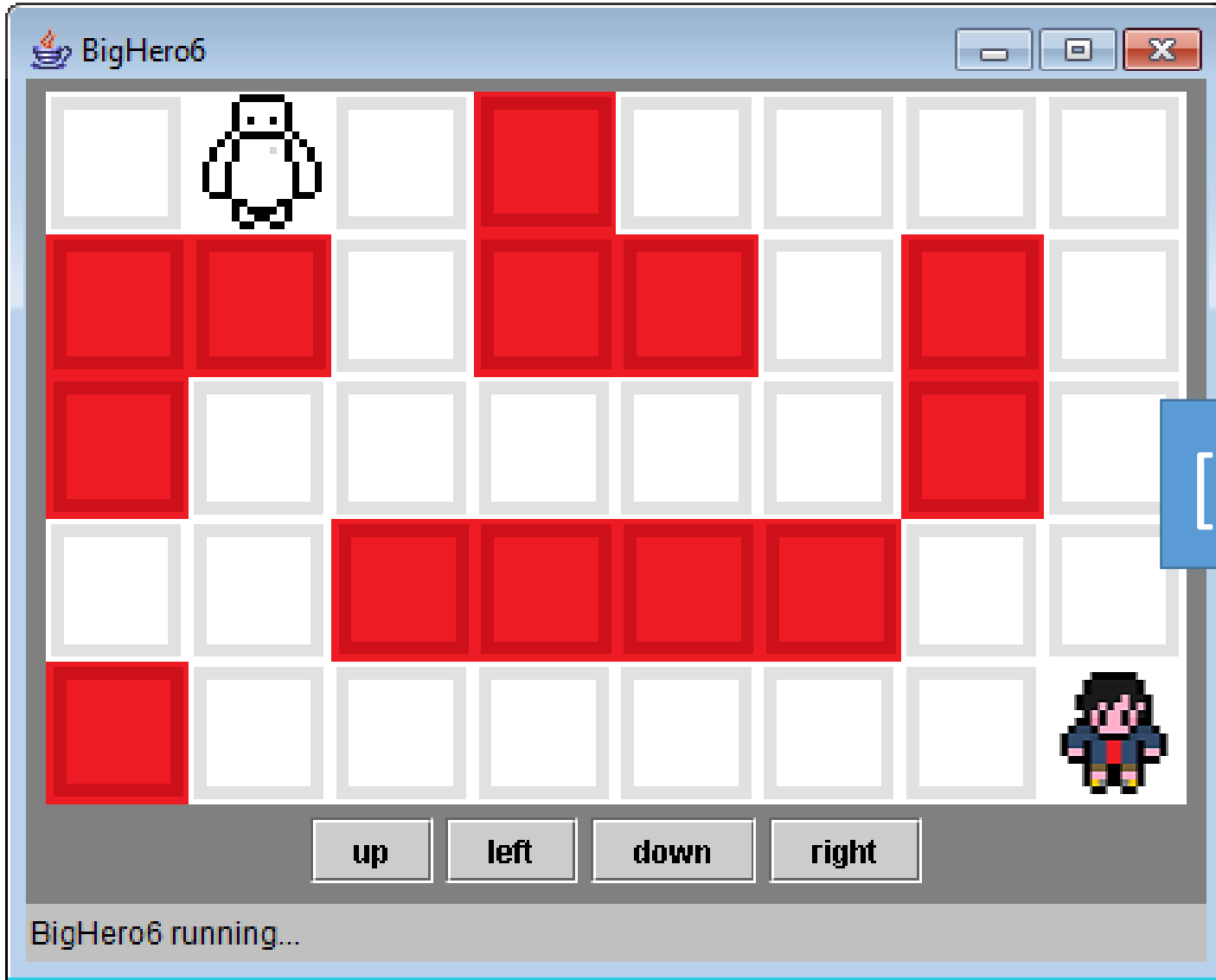
Movement

2D Arrays

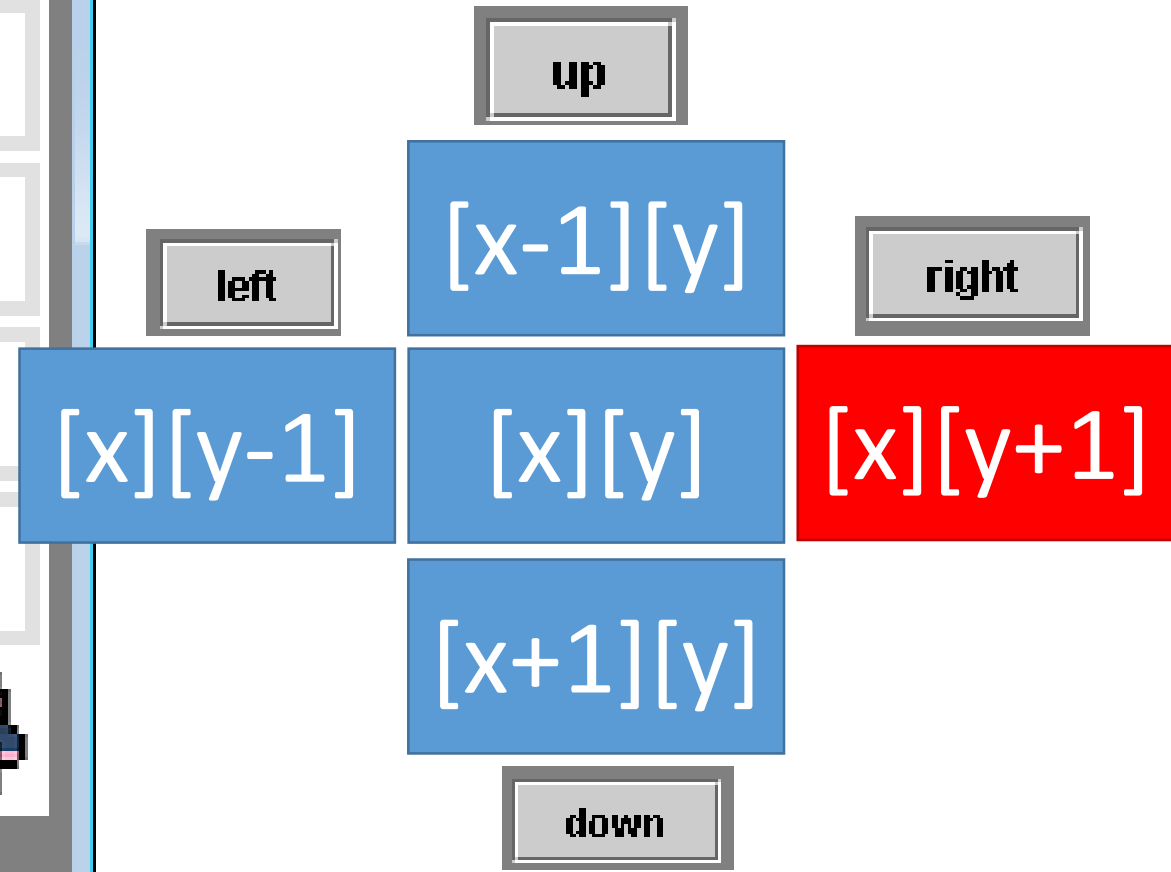
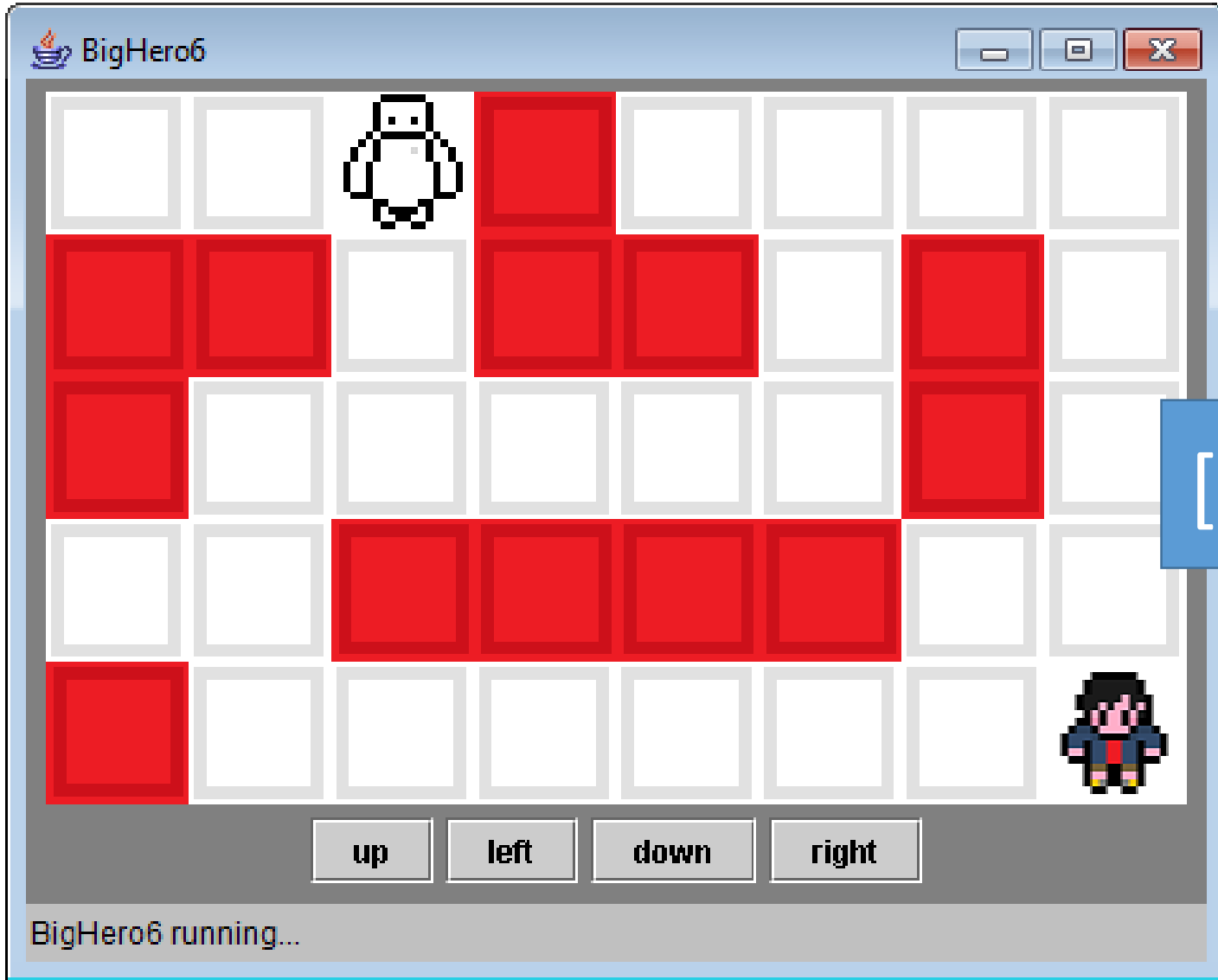




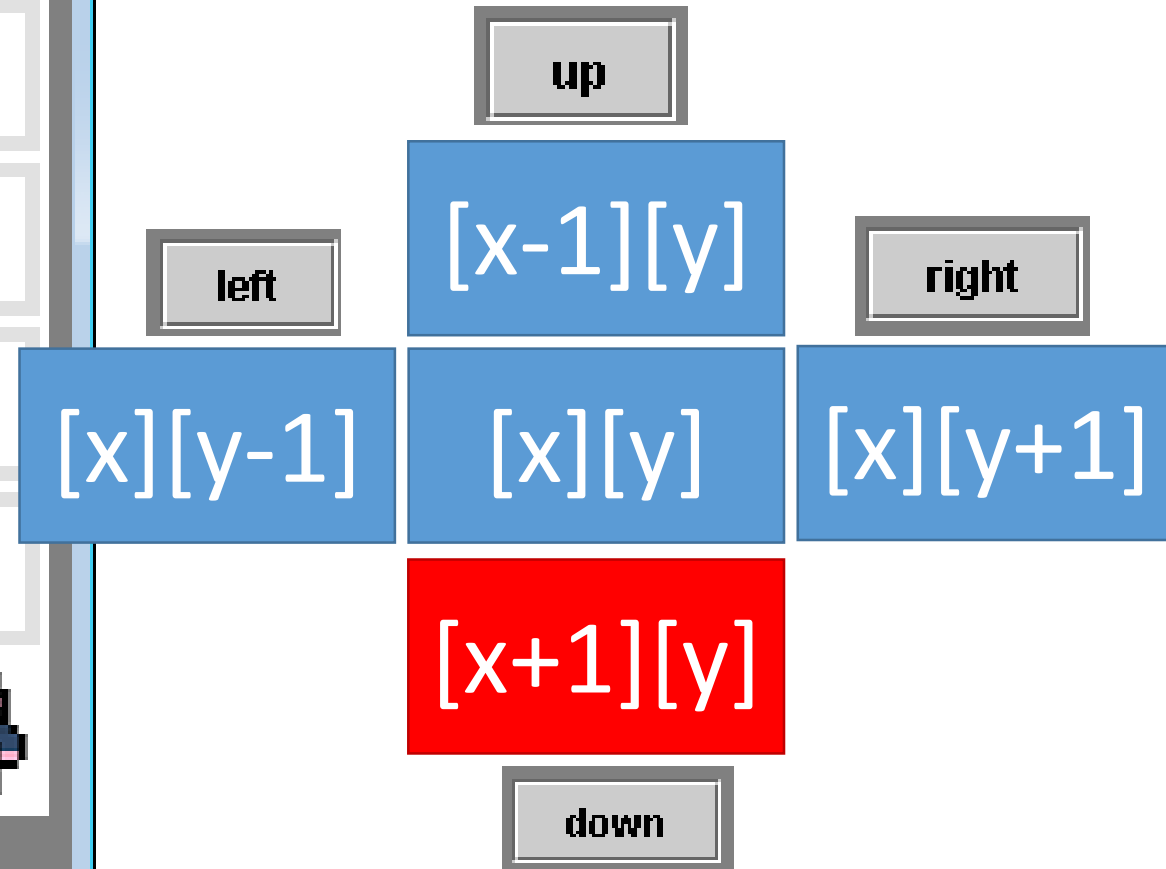
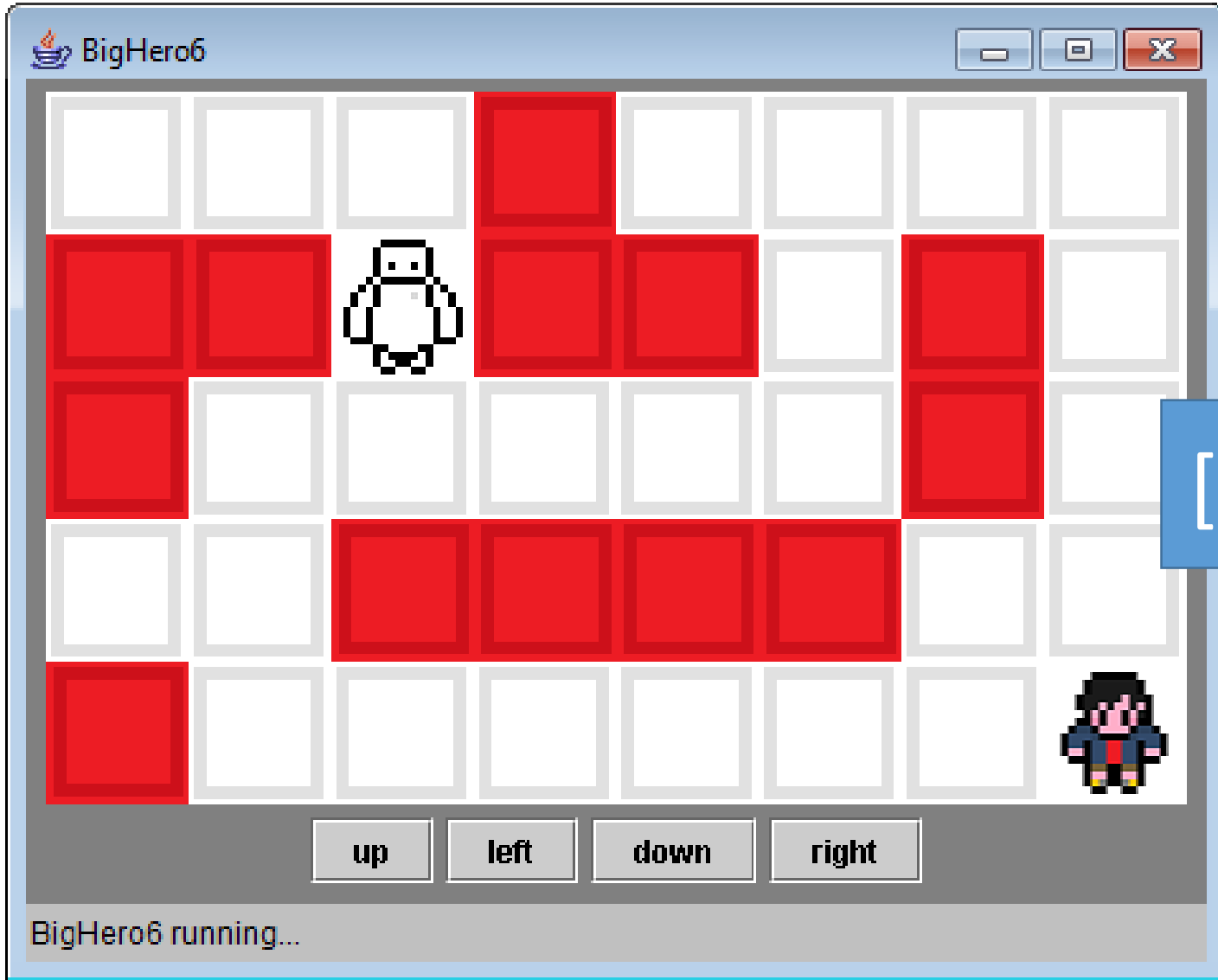
$$[x][y]=[0][0]$$



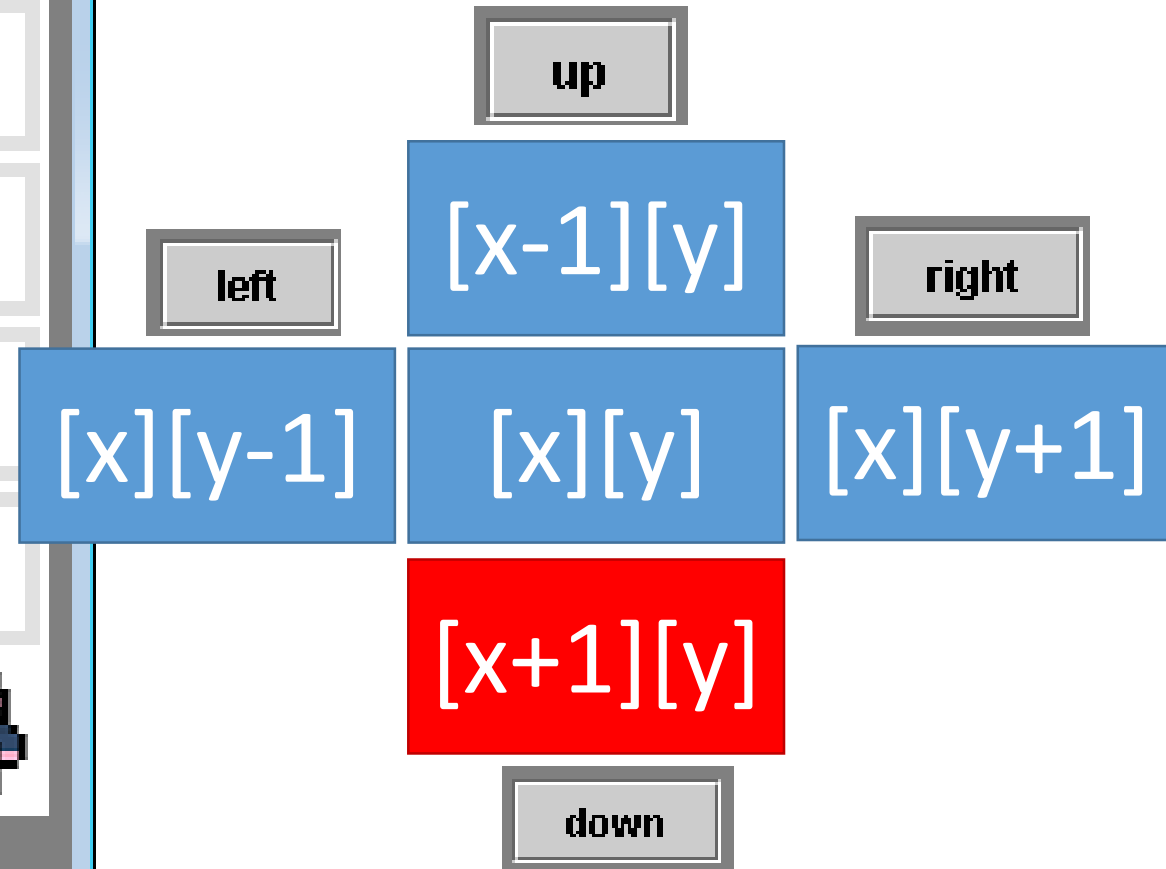
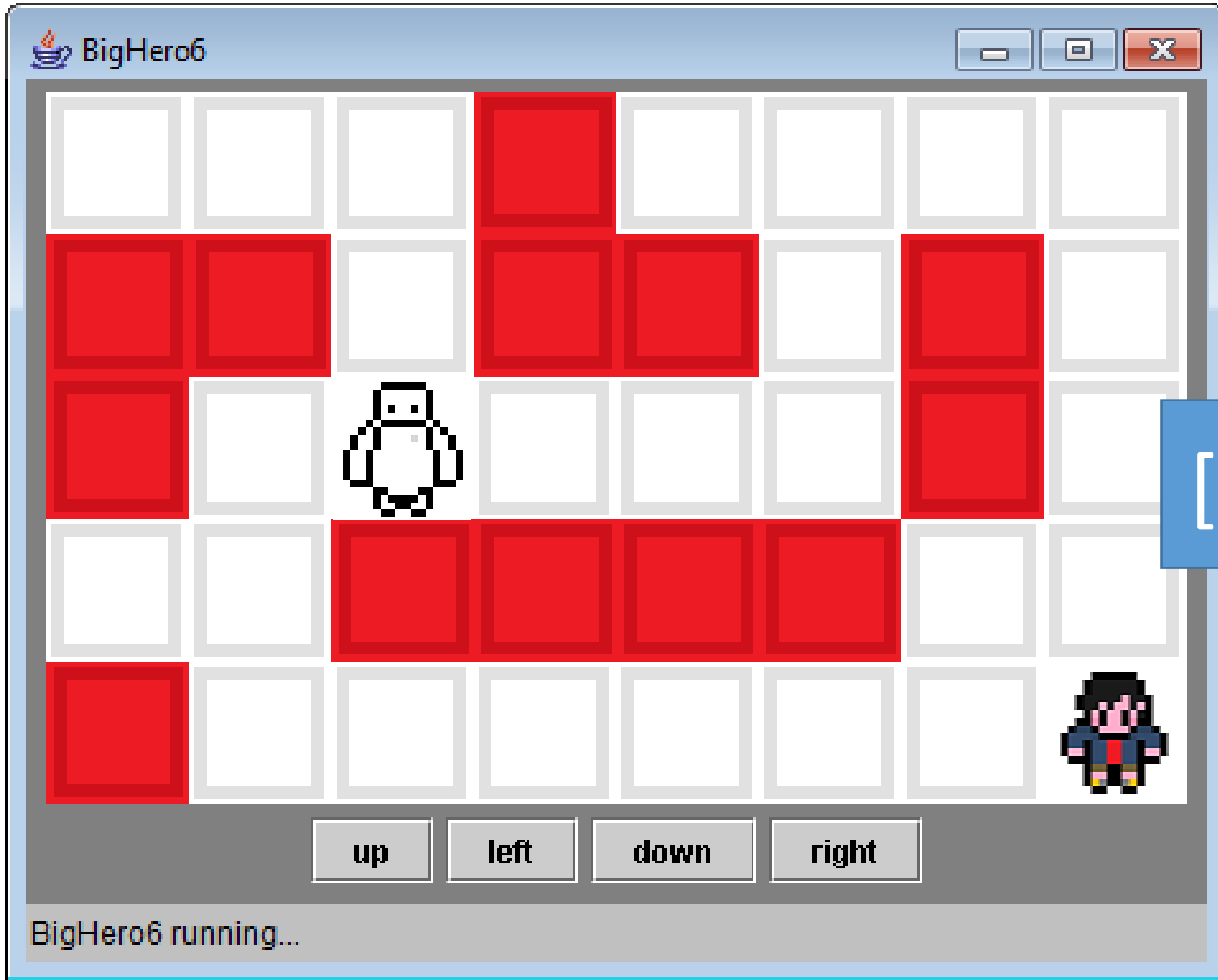
$$[x][y]=[0][1]$$



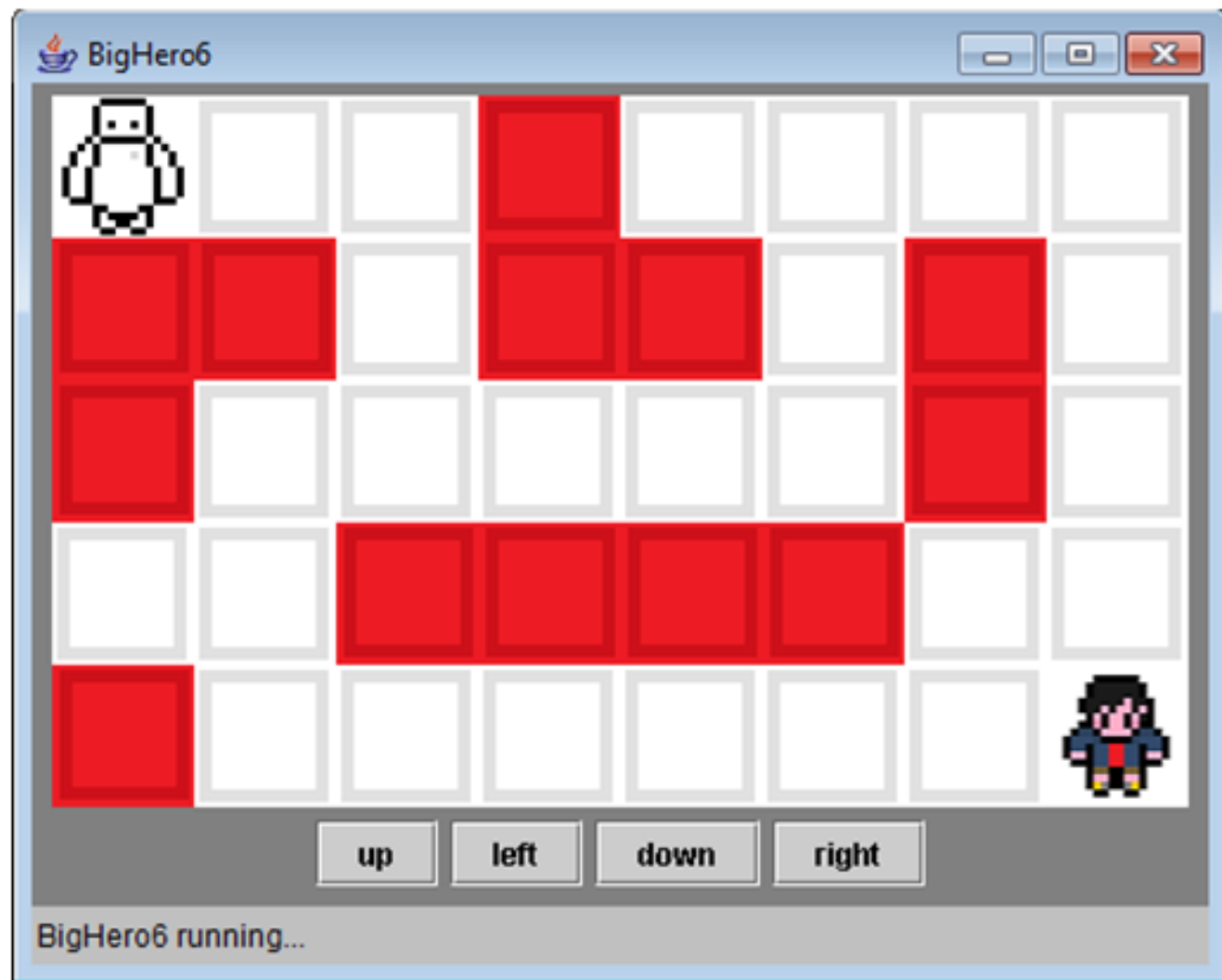
$$[x][y]=[0][2]$$



$$[x][y]=[1][2]$$



$$[x][y]=[2][2]$$



bh1.png



bh2.png



bh3.png



bh4.png

Consider the picture on the left.

1. How many rows?
2. How many columns?
3. What picture is in:
 - (a) hero[0][0]?
 - (b) hero[3][1]?
 - (c) hero[4][7]?
4. How many direction buttons?
5. Where does Baymax start?
hero[___][___];
6. Where does Hiro start?
hero[___][___];

7. Fill in the init method's code to produce the screen shown.

```
import javax.swing.*; import java.applet.*; import java.awt.event.*; import java.awt.*;

public class BigHero6 extends Applet implements ActionListener
{ int hero[] [] = {{____, ____ , ____ , ____ , ____ , ____ , ____ , ____},
                  {____, ____ , ____ , ____ , ____ , ____ , ____ , ____},
                  {____, ____ , ____ , ____ , ____ , ____ , ____ , ____},
                  {____, ____ , ____ , ____ , ____ , ____ , ____ , ____},
                  {____, ____ , ____ , ____ , ____ , ____ , ____ , ____}};

int row = ____; //Where did Baymax begin?
int col = ____; int x = ____;
JLabel pics[] = new JLabel [row * col]; int y = ____;

public void init ()
{ setBackground (Color.gray);
  Panel grid = new Panel (new GridLayout (____, ____));
  int m = 0;
  for (int i = 0 ; i < ____ ; i++)
  { for (int j = 0 ; j < ____ ; j++)
    { pics [m] = new JLabel (createImageIcon ("bh" + hero [i] [j] + ".png"));
      pics [m].setPreferredSize (new Dimension (56, 56));
      grid.add (pics [m]);
      m++;
    }
  }
  add (grid);
}
```

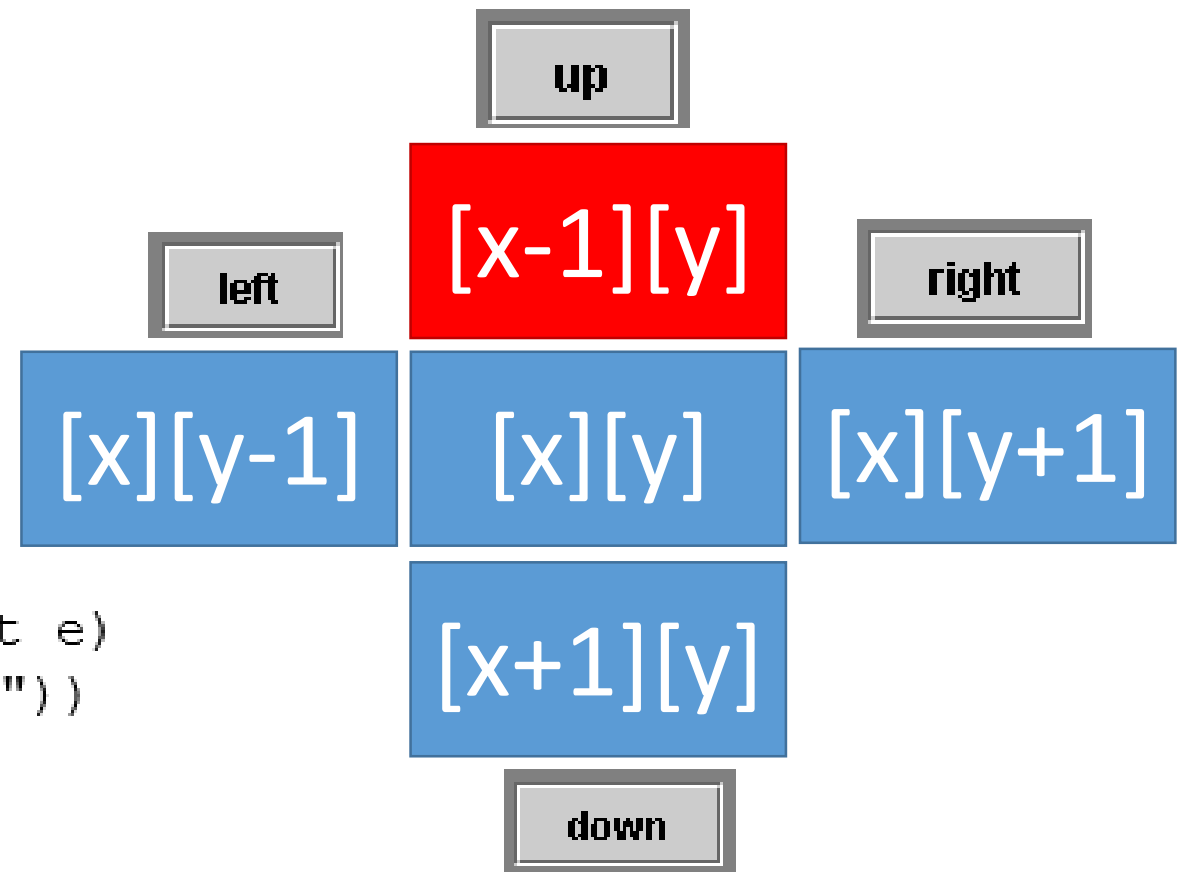


```
JButton up = new JButton ("_____");
up.setActionCommand ("up");
up.addActionListener (this);
add (up);
JButton left = new JButton ("_____");
left.setActionCommand ("left");
left.addActionListener (this);
add (left);
//move Baymax to the start position
pics [x * col + y].setIcon (createImageIcon ("bh1.png"));
```

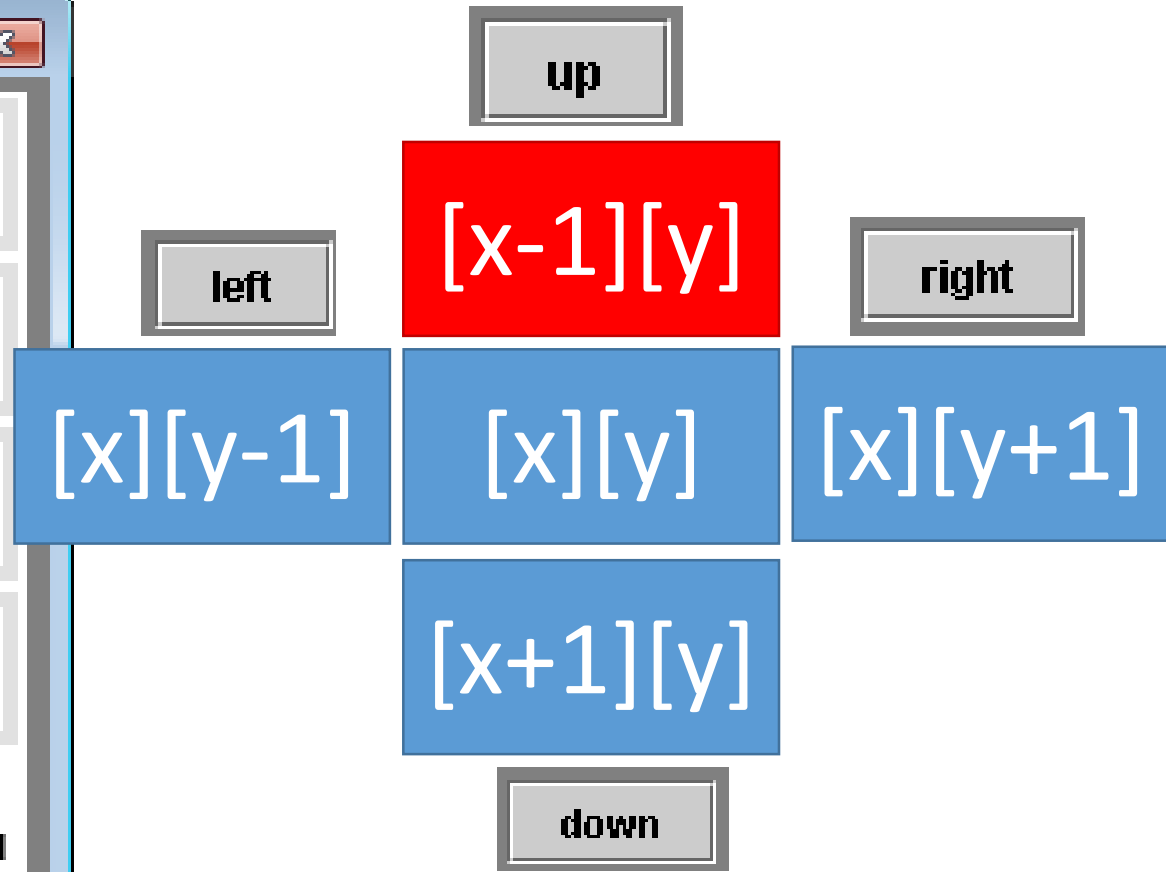
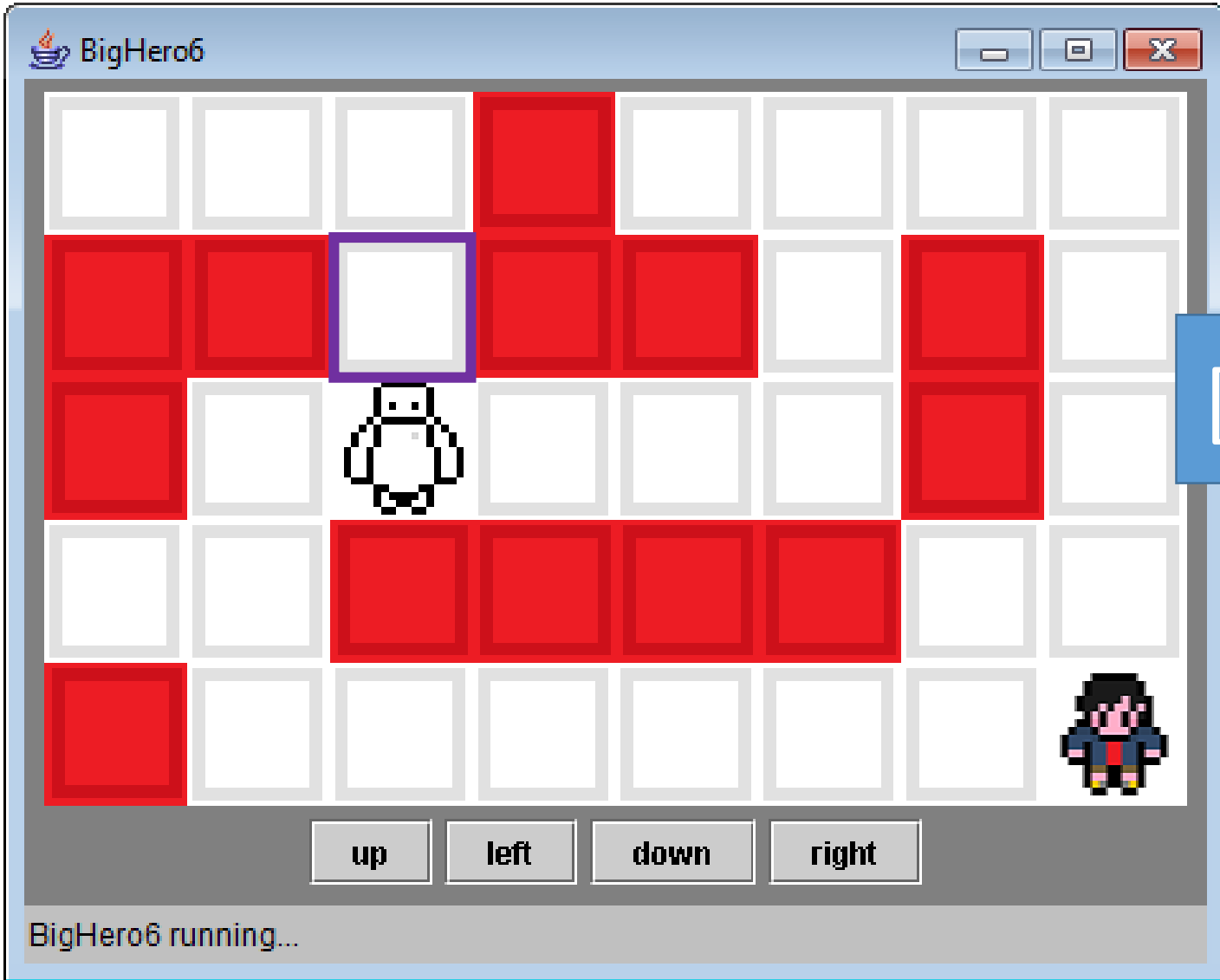
```
JButton down = new JButton ("_____");
down.setActionCommand ("down");
down.addActionListener (this);
add (down);
JButton right = new JButton ("_____");
right.setActionCommand ("right");
right.addActionListener (this);
add (right);
```

Moving Up

- Edge guard: $x-1 < 0$, have fallen off the board.
- Check in spot $[x-1][y]$
- $x--$ to adjust position

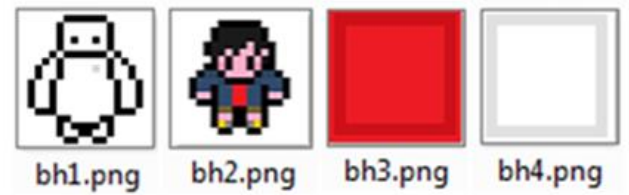


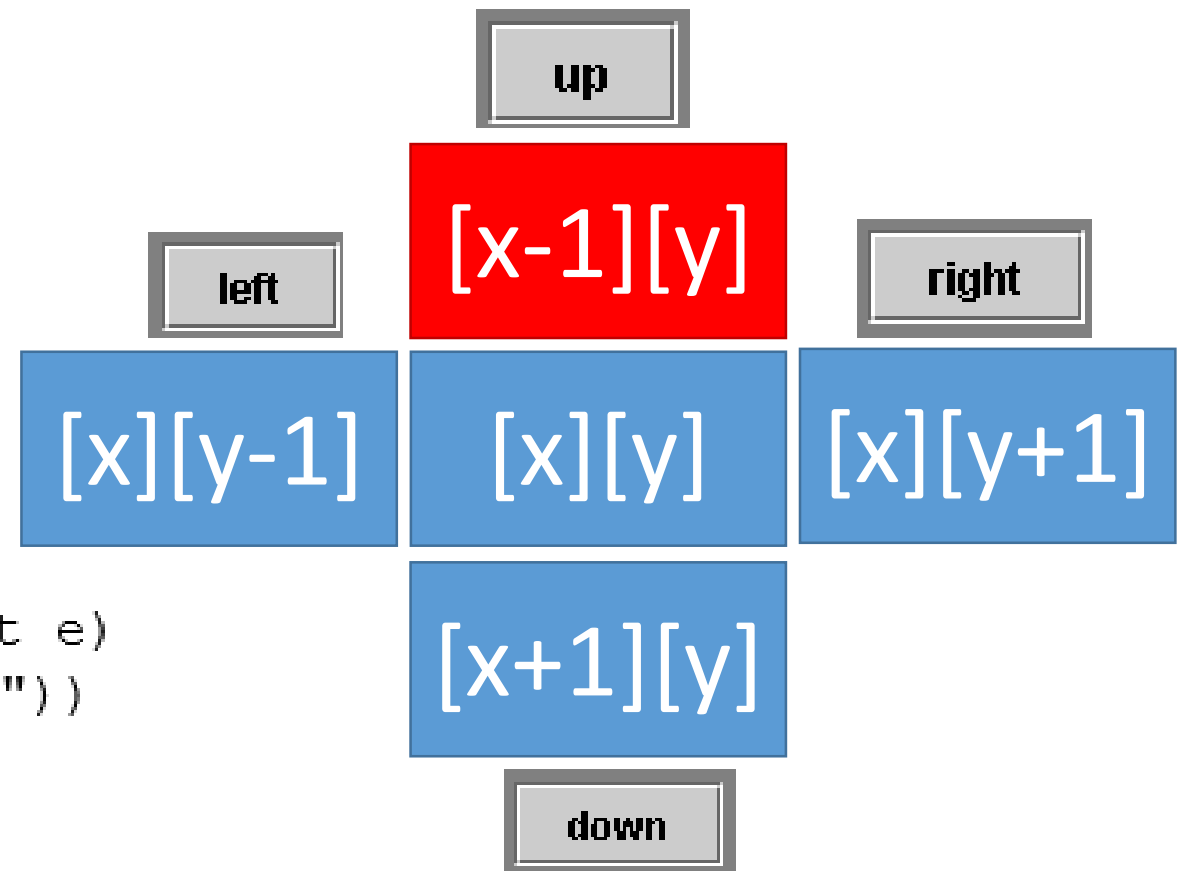
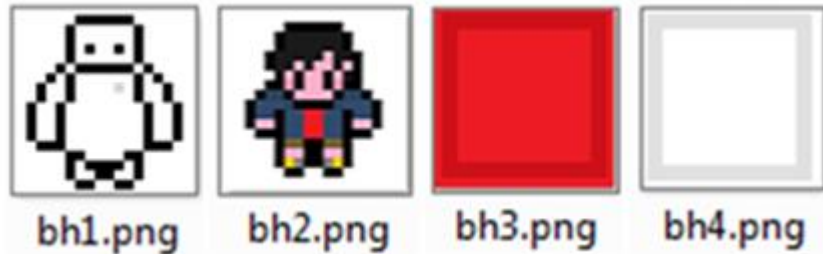
```
public void actionPerformed (ActionEvent e)
{ if (e.getActionCommand ().equals ("up"))
  { if (x - 1 < 0)
    showStatus ("Off the board!!");
  else if (hero [x - 1] [y] != 4)
    showStatus ("There is a wall.");
  else
  { showStatus ("OK! Moving up.");
    pics [x * col + y].setIcon (createImageIcon ("bh4.png"));
    x--;
    pics [x * col + y].setIcon (createImageIcon ("bh1.png"));
  }
}
```



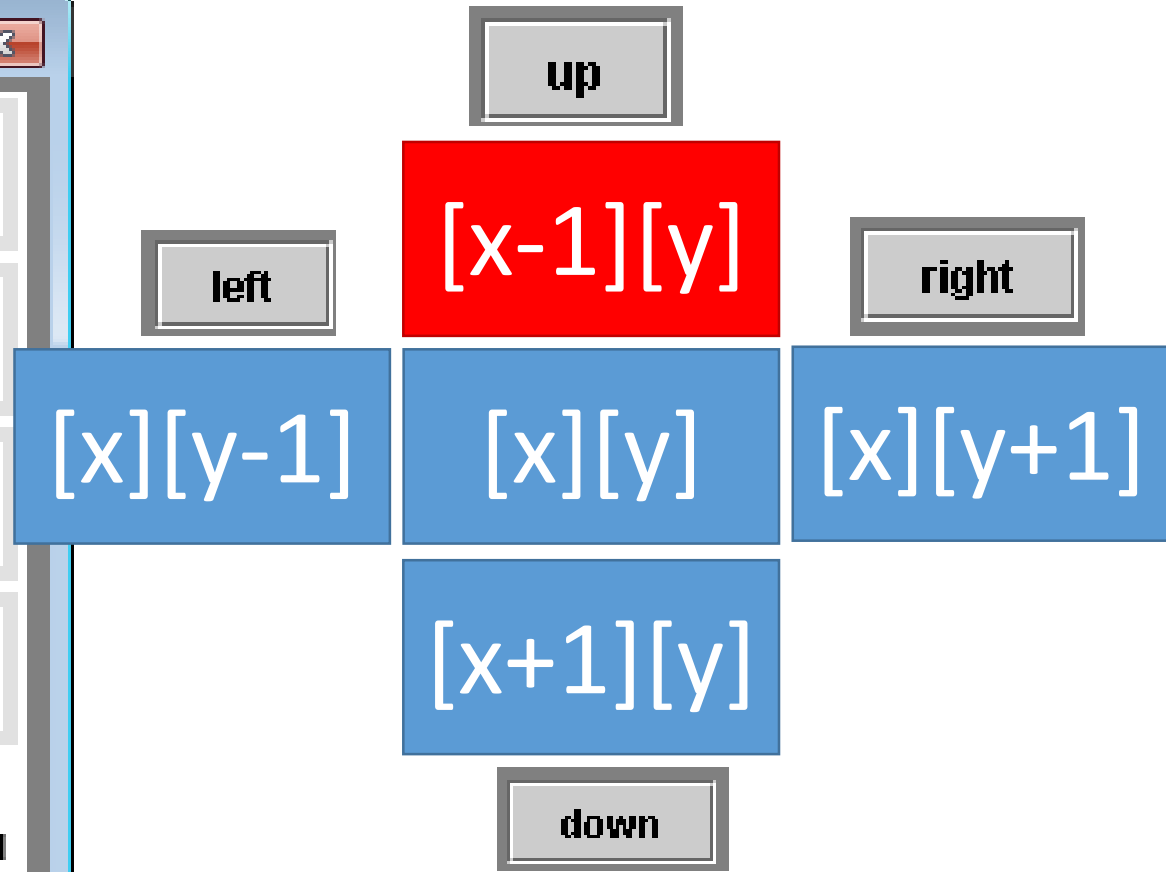
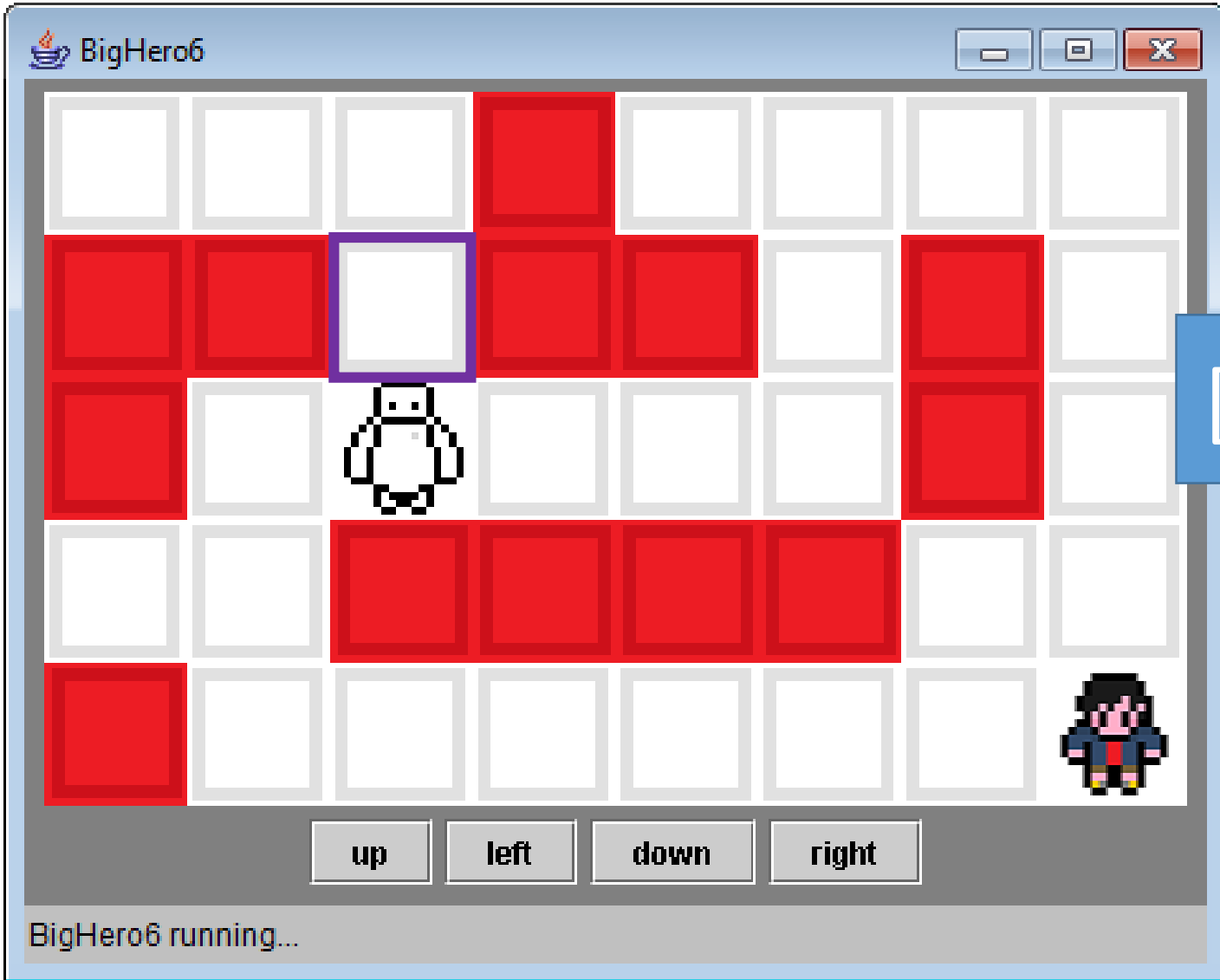
$[x][y]=[2][2]$

```
if (x - 1 < 0)
showStatus ("Off the board!!");
```



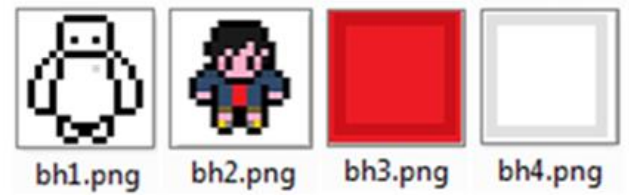


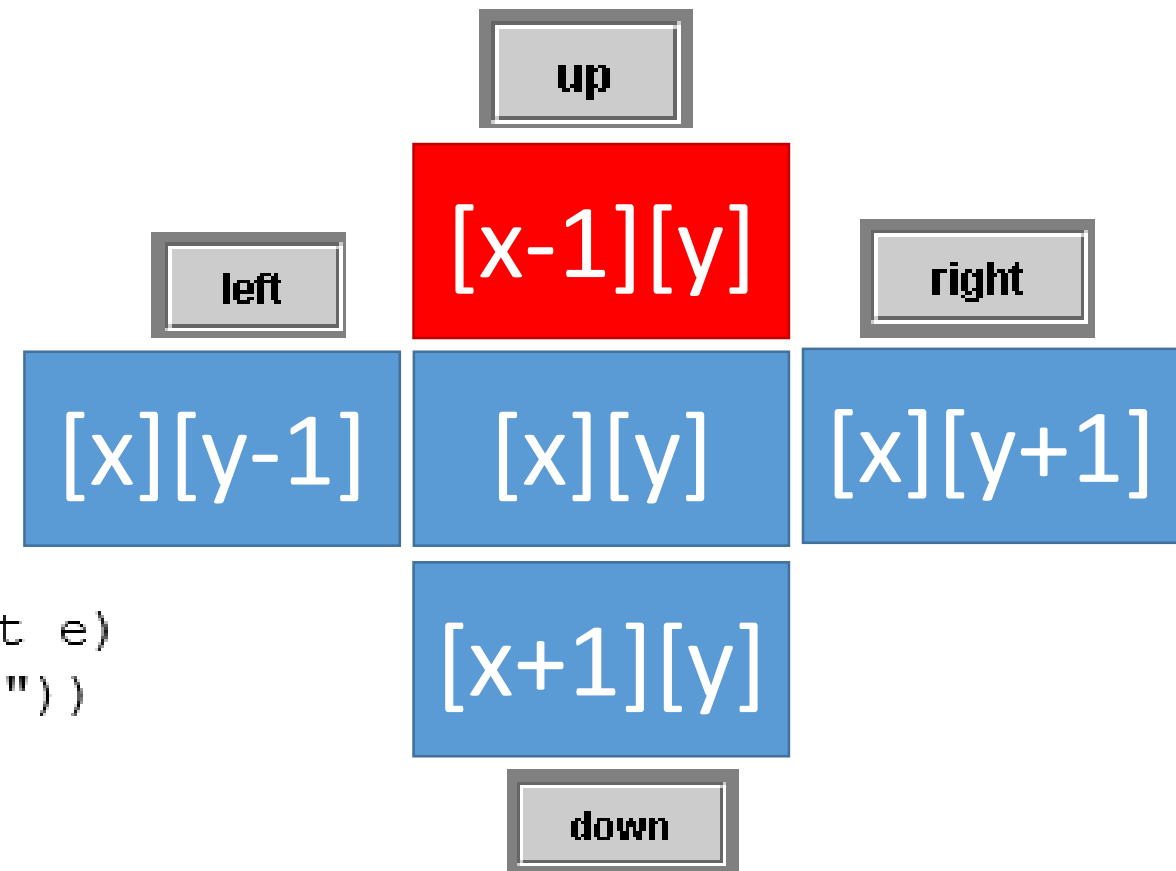
```
public void actionPerformed (ActionEvent e)
{ if (e.getActionCommand ().equals ("up"))
  { if (x - 1 < 0)
    showStatus ("Off the board!!");
  else if (hero [x - 1] [y] != 4)
    showStatus ("There is a wall.");
  else
  { showStatus ("OK! Moving up.");
    pics [x * col + y].setIcon (createImageIcon ("bh4.png"));
    x--;
    pics [x * col + y].setIcon (createImageIcon ("bh1.png"));
  }
}
```



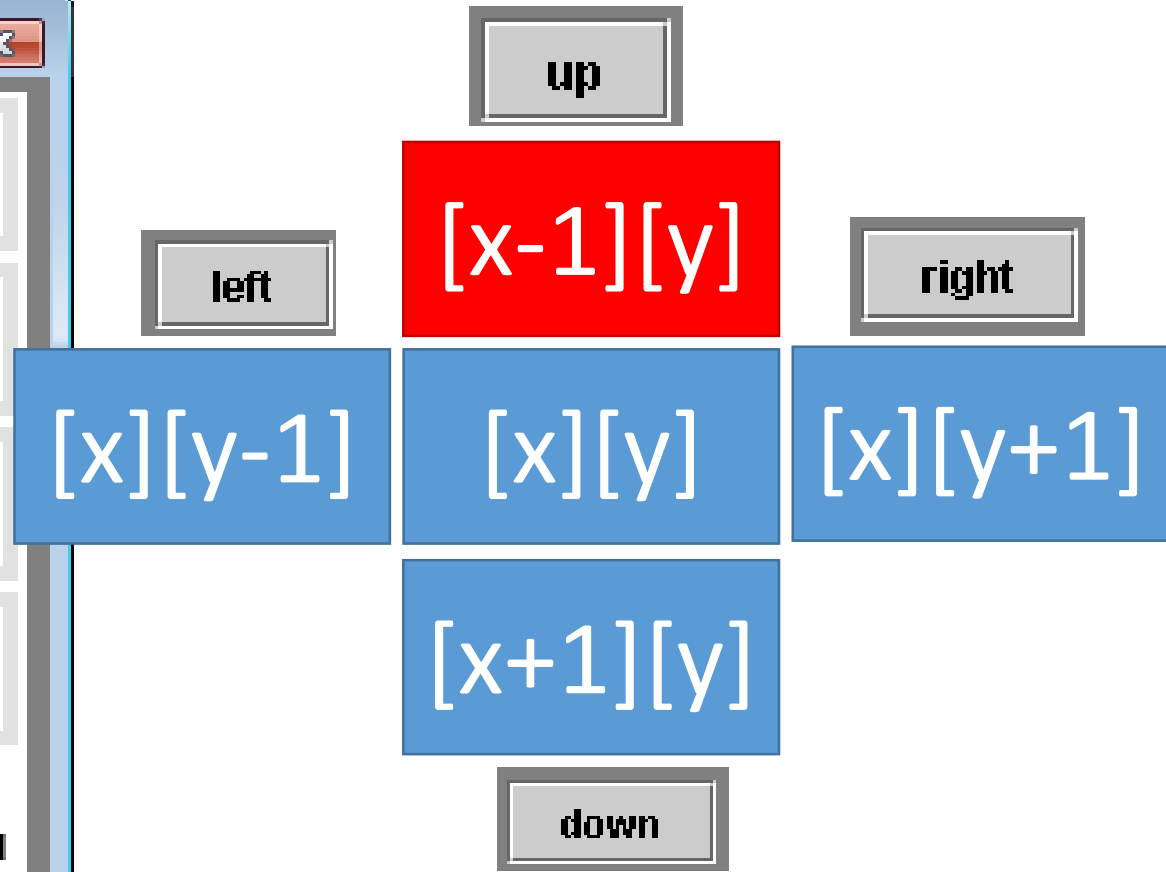
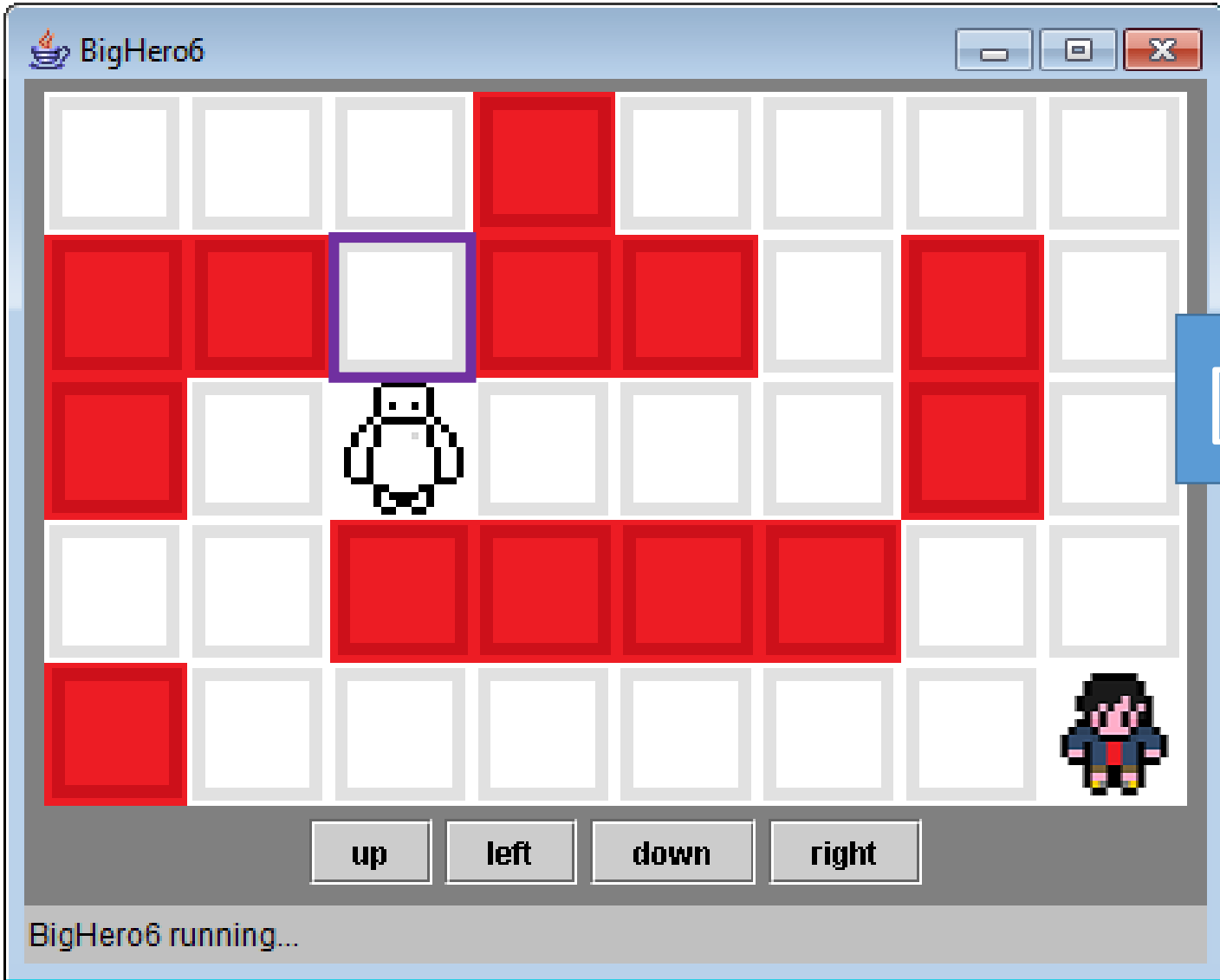
$[x][y]=[2][2]$

```
else if (hero [x - 1] [y] != 4)
    showStatus ("There is a wall.");
```





```
public void actionPerformed (ActionEvent e)
{ if (e.getActionCommand ().equals ("up"))
  { if (x - 1 < 0)
    showStatus ("Off the board!!");
  else if (hero [x - 1] [y] != 4)
    showStatus ("There is a wall.");
  else
  { showStatus ("OK! Moving up.");
    pics [x * col + y].setIcon (createImageIcon ("bh4.png"));
    x--;
    pics [x * col + y].setIcon (createImageIcon ("bh1.png"));
  }
}
```

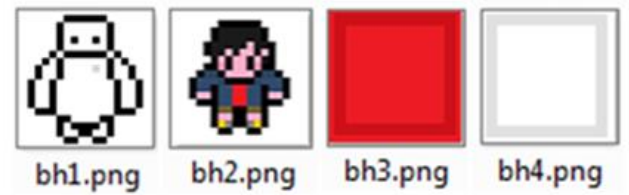


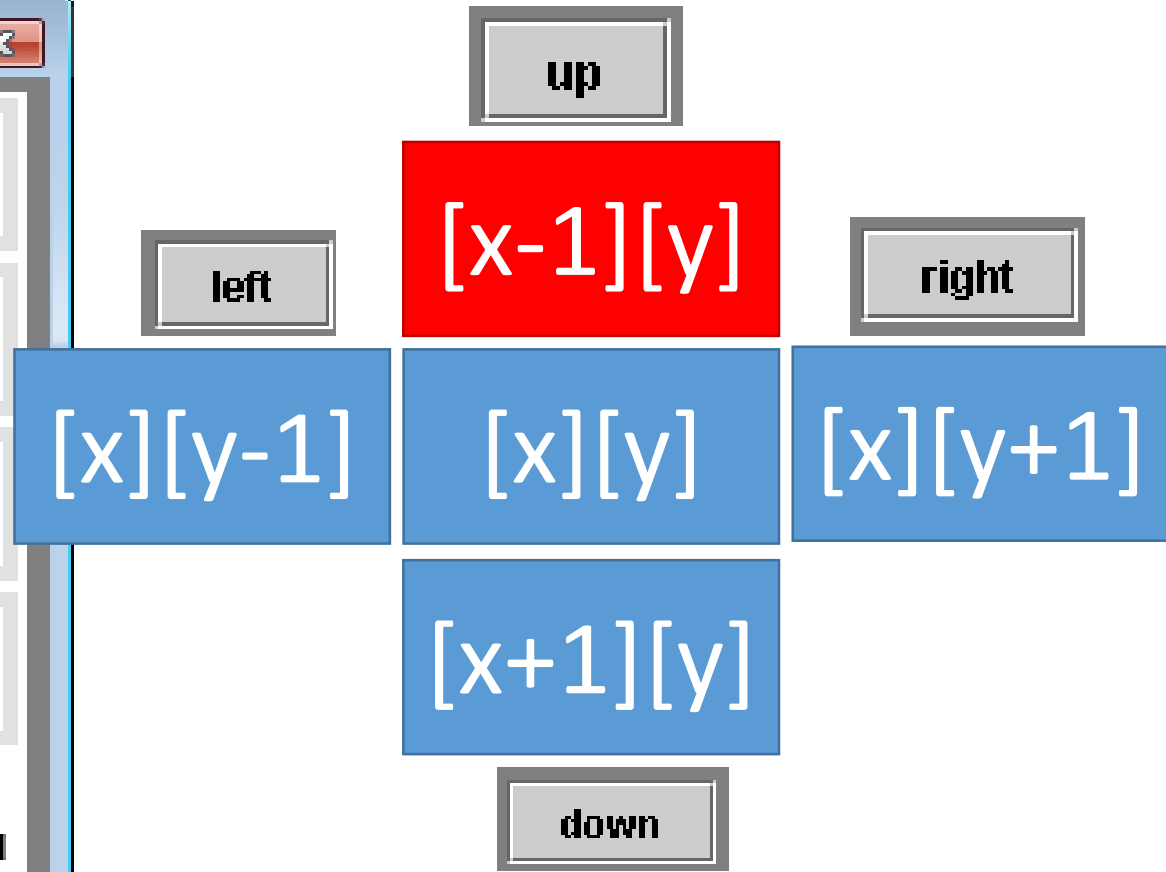
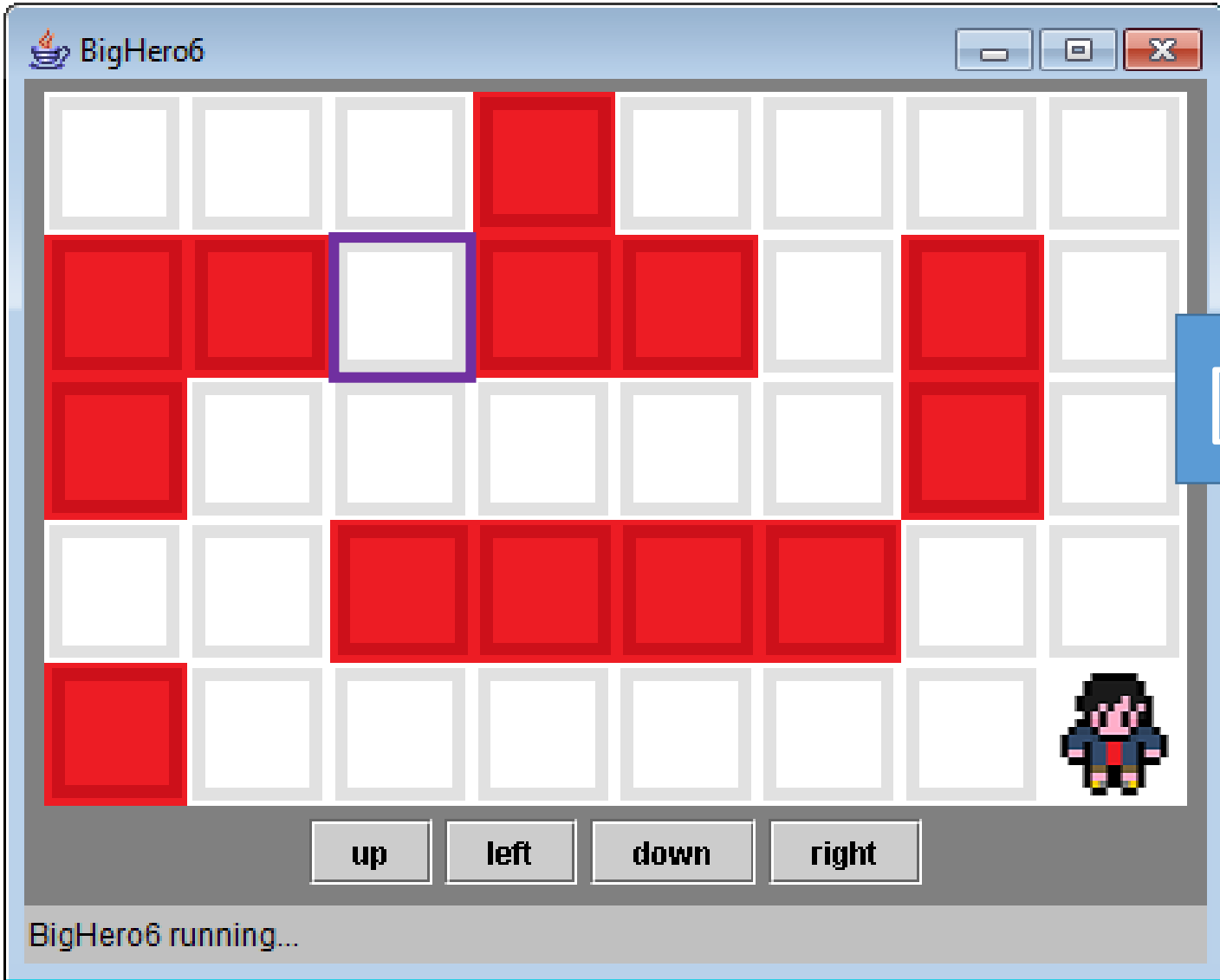
$[x][y]=[2][2]$

```

{ showStatus ("OK! Moving up.");
  pics [x * col + y].setIcon (createImageIcon ("bh4.png"));
  x--;
  pics [x * col + y].setIcon (createImageIcon ("bh1.png"));
}

```



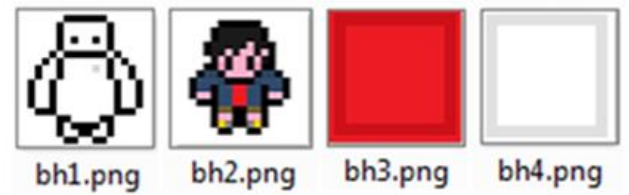


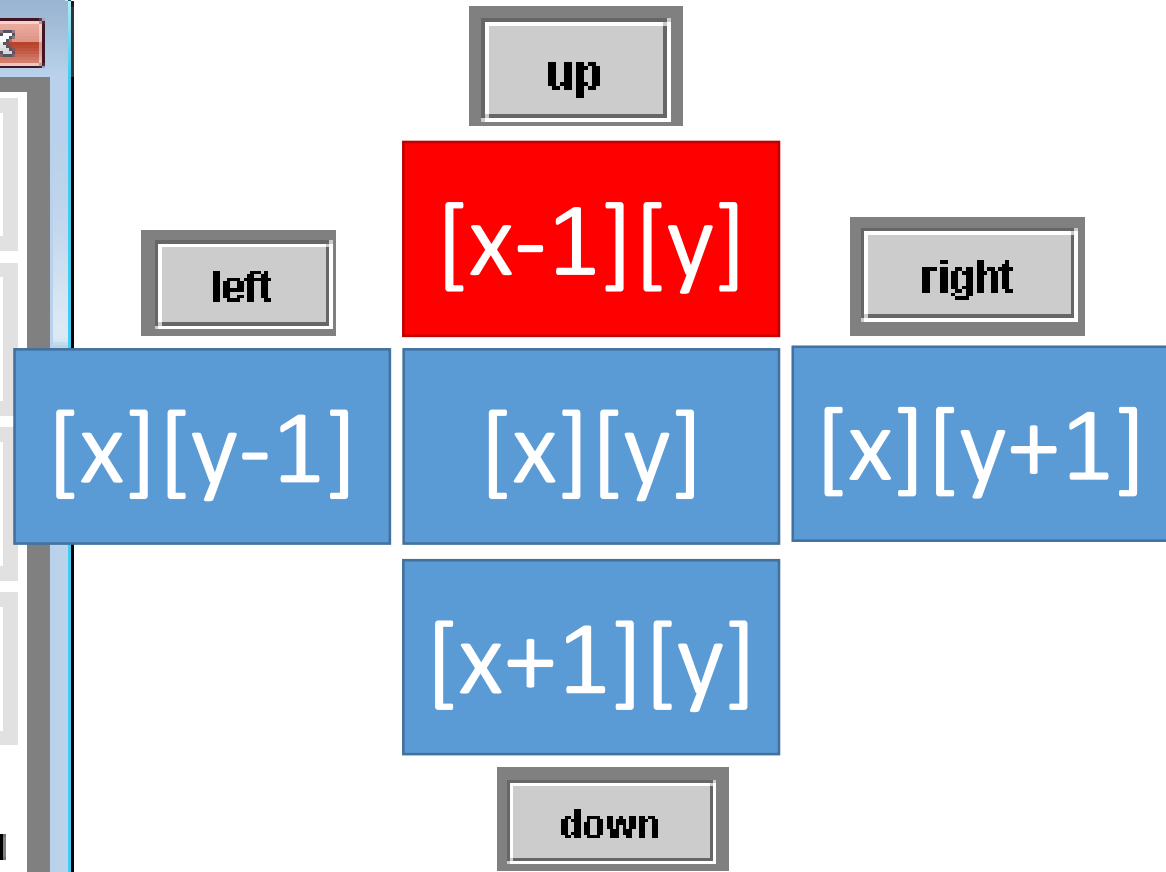
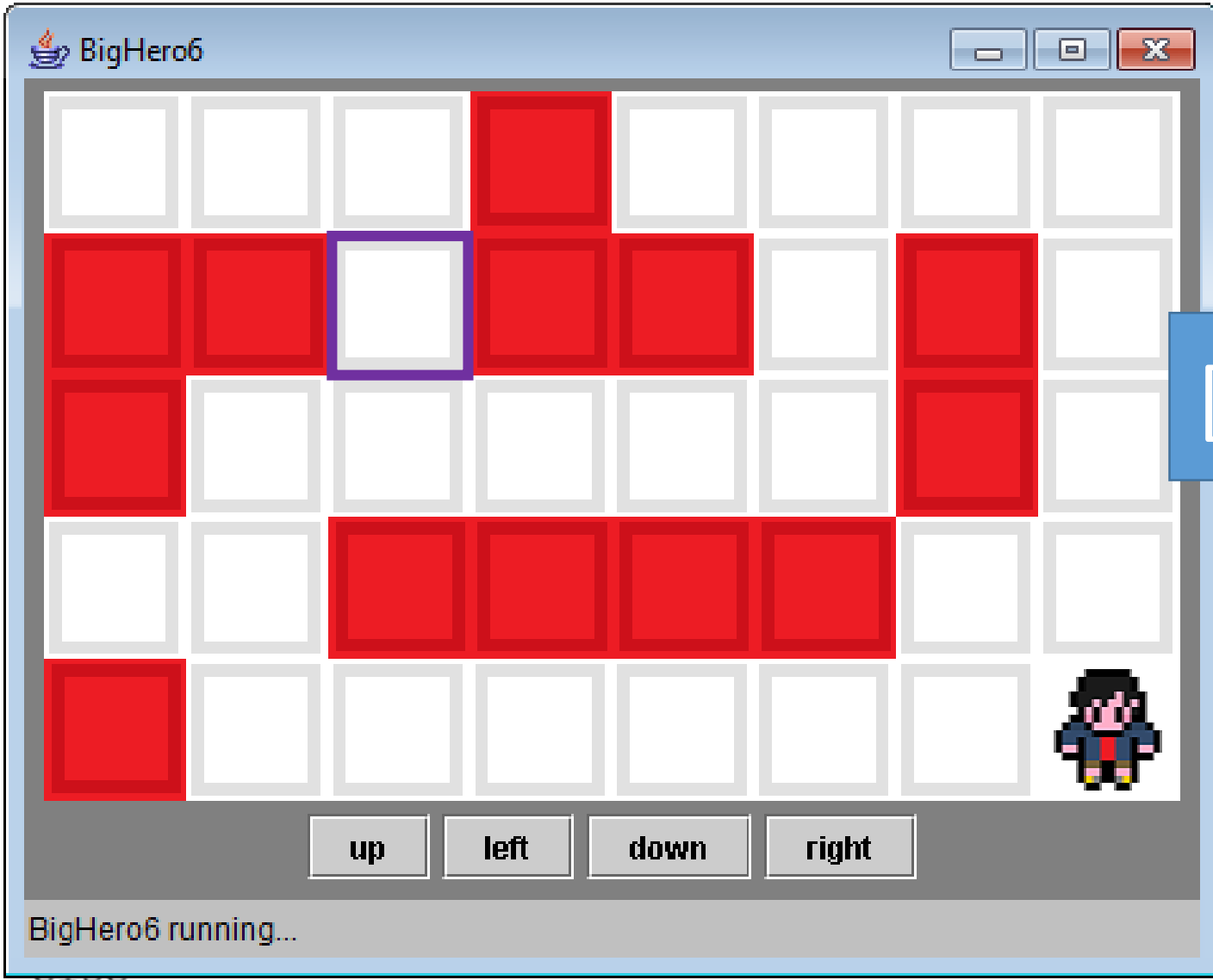
$[x][y]=[2][2]$

```

{ showStatus ("OK! Moving up.");
  pics [x * col + y].setIcon (createImageIcon ("bh4.png"));
  x--;
  pics [x * col + y].setIcon (createImageIcon ("bh1.png"));
}

```



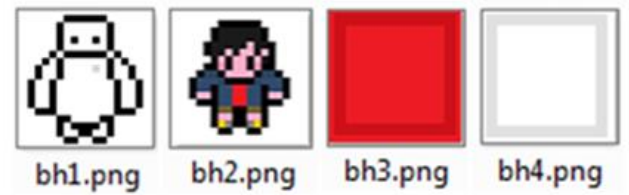


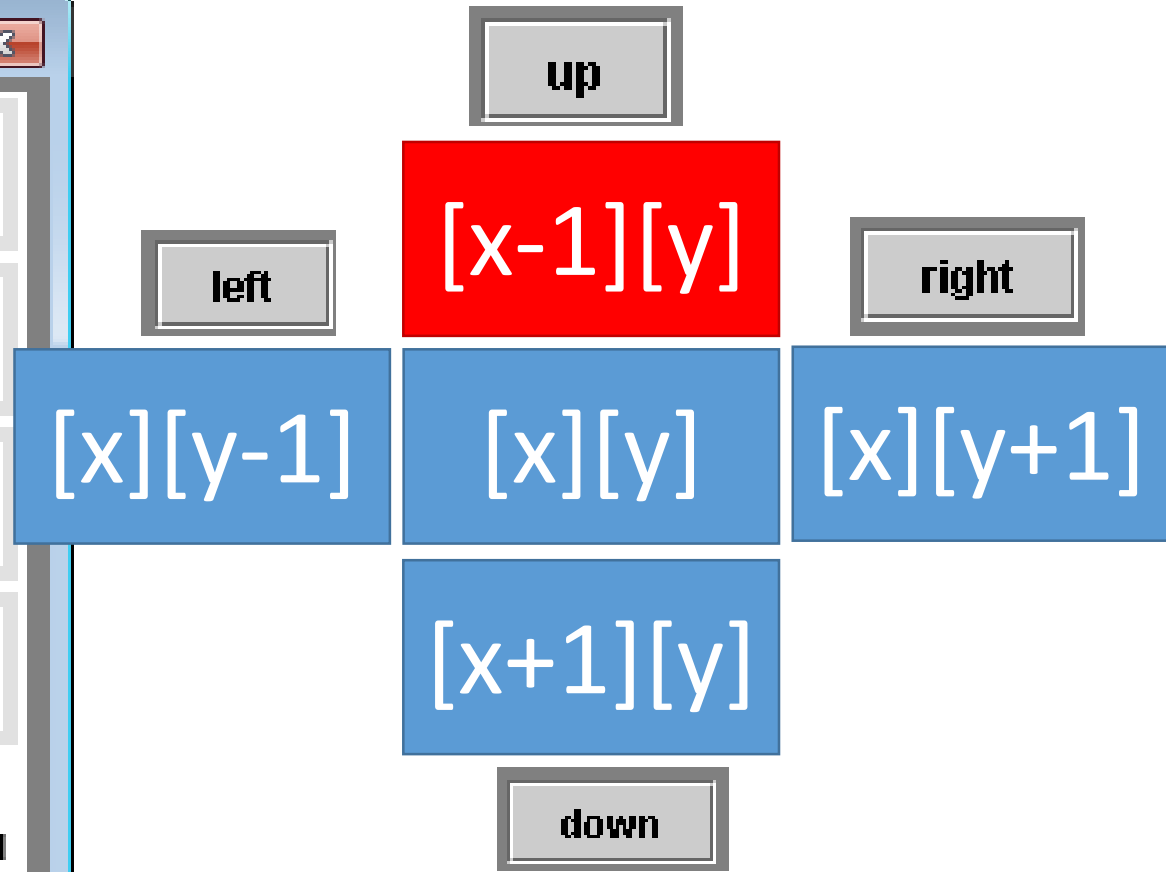
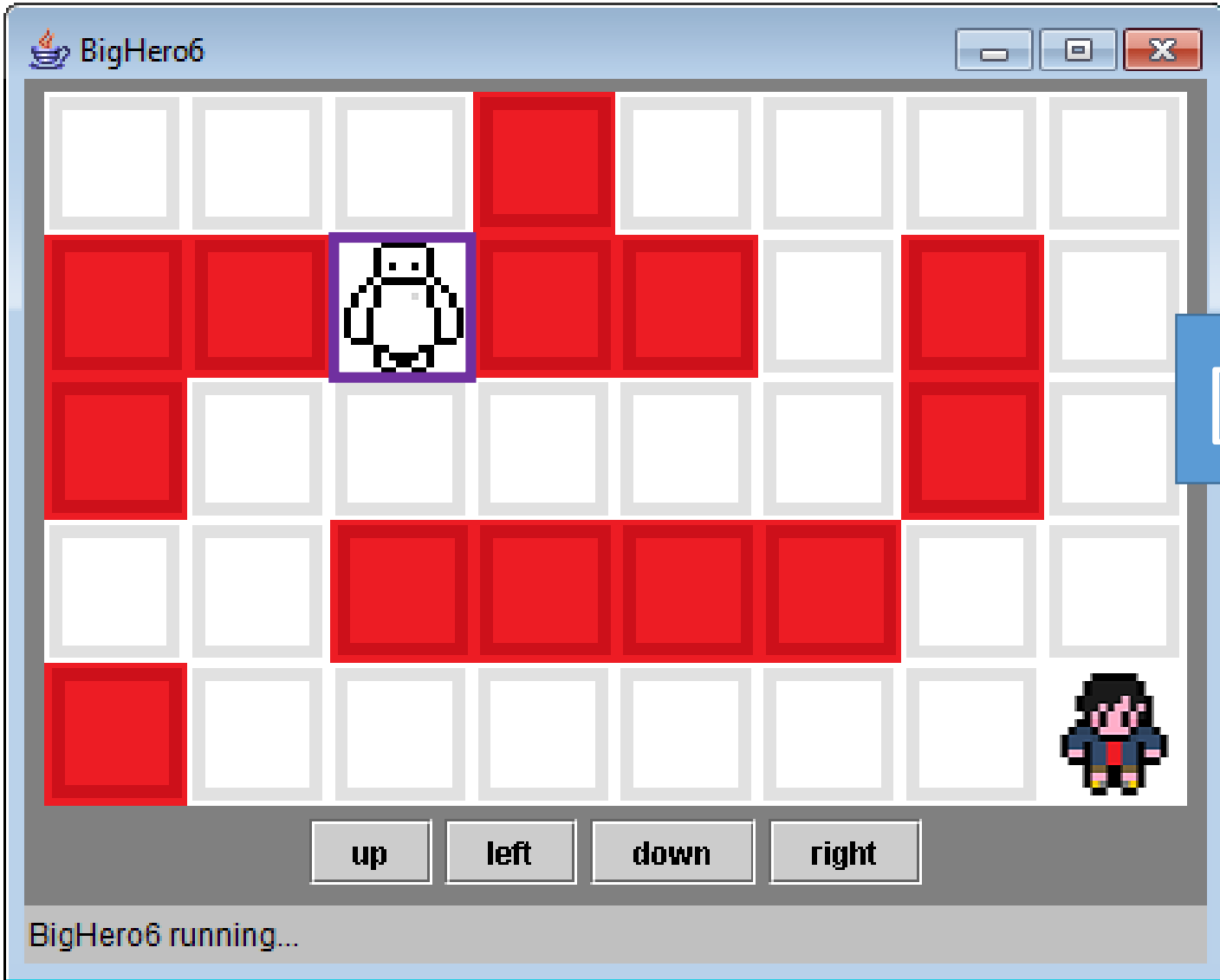
$[x][y]=[1][2]$

```

{ showStatus ("OK! Moving up.");
  pics [x * col + y].setIcon (createImageIcon ("bh4.png"));
  x--;
  pics [x * col + y].setIcon (createImageIcon ("bh1.png"));
}

```



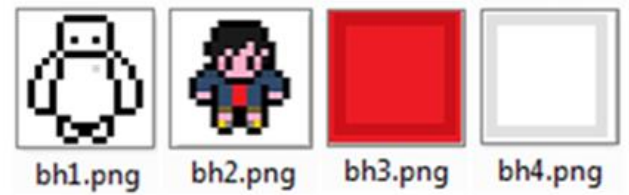


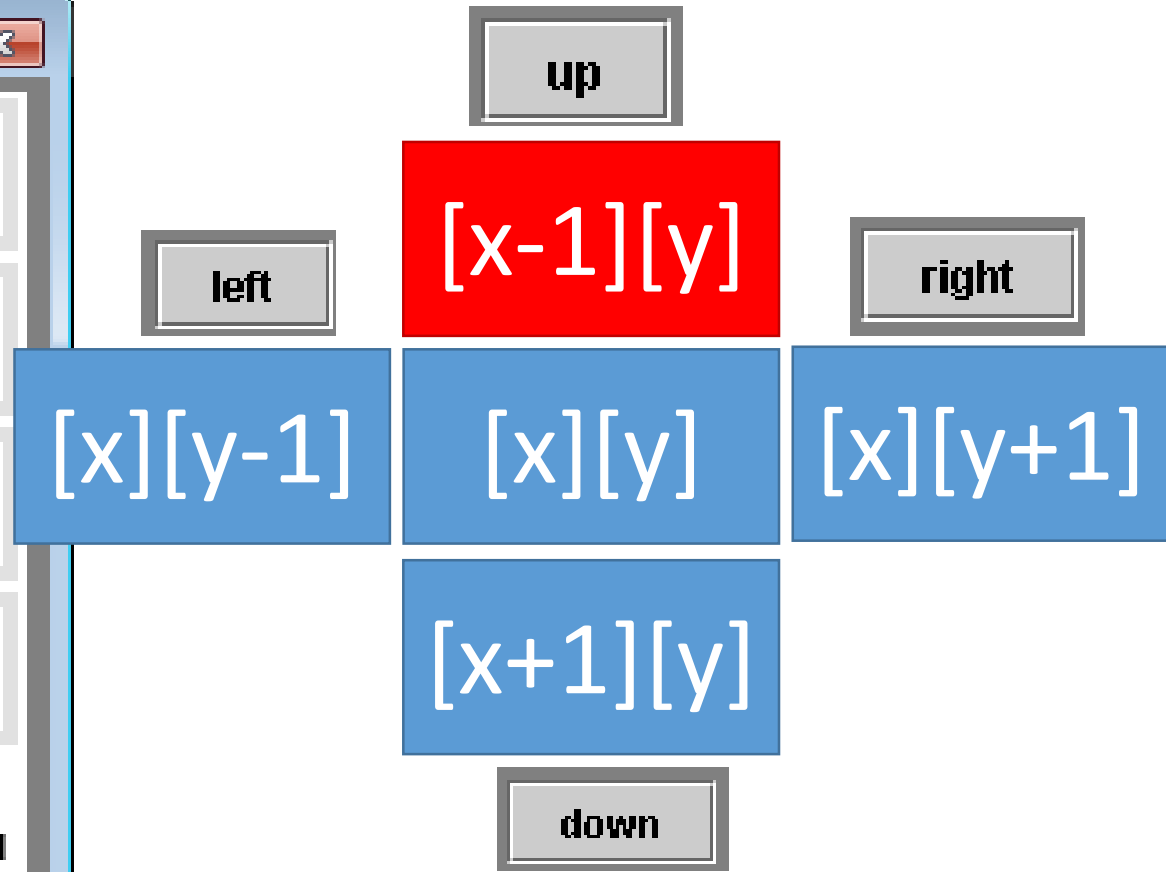
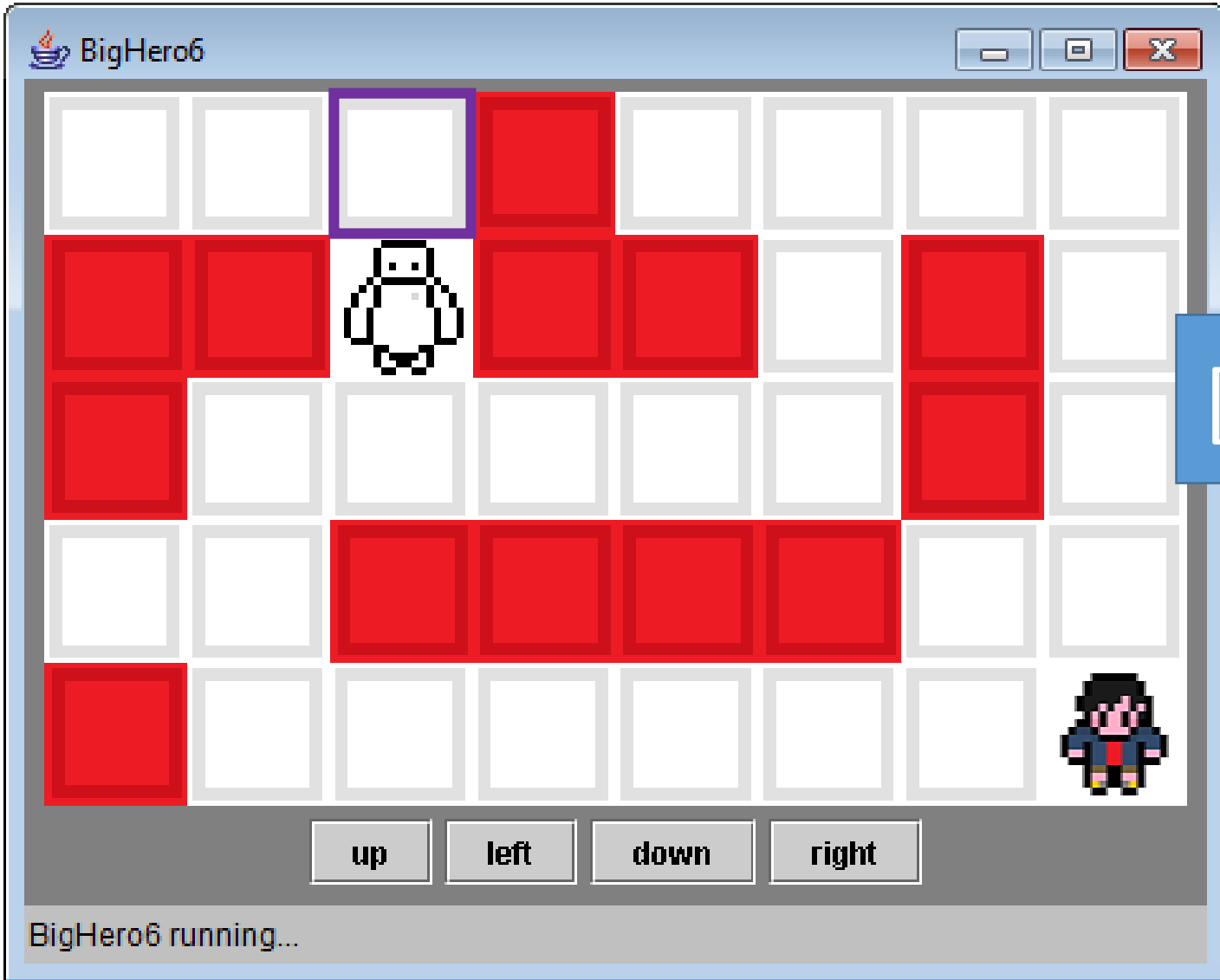
$[x][y]=[1][2]$

```

{ showStatus ("OK! Moving up.");
  pics [x * col + y].setIcon (createImageIcon ("bh4.png"));
  x--;
  pics [x * col + y].setIcon (createImageIcon ("bh1.png"));
}

```



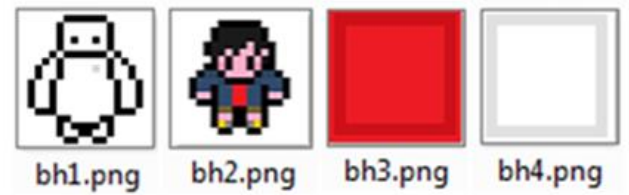


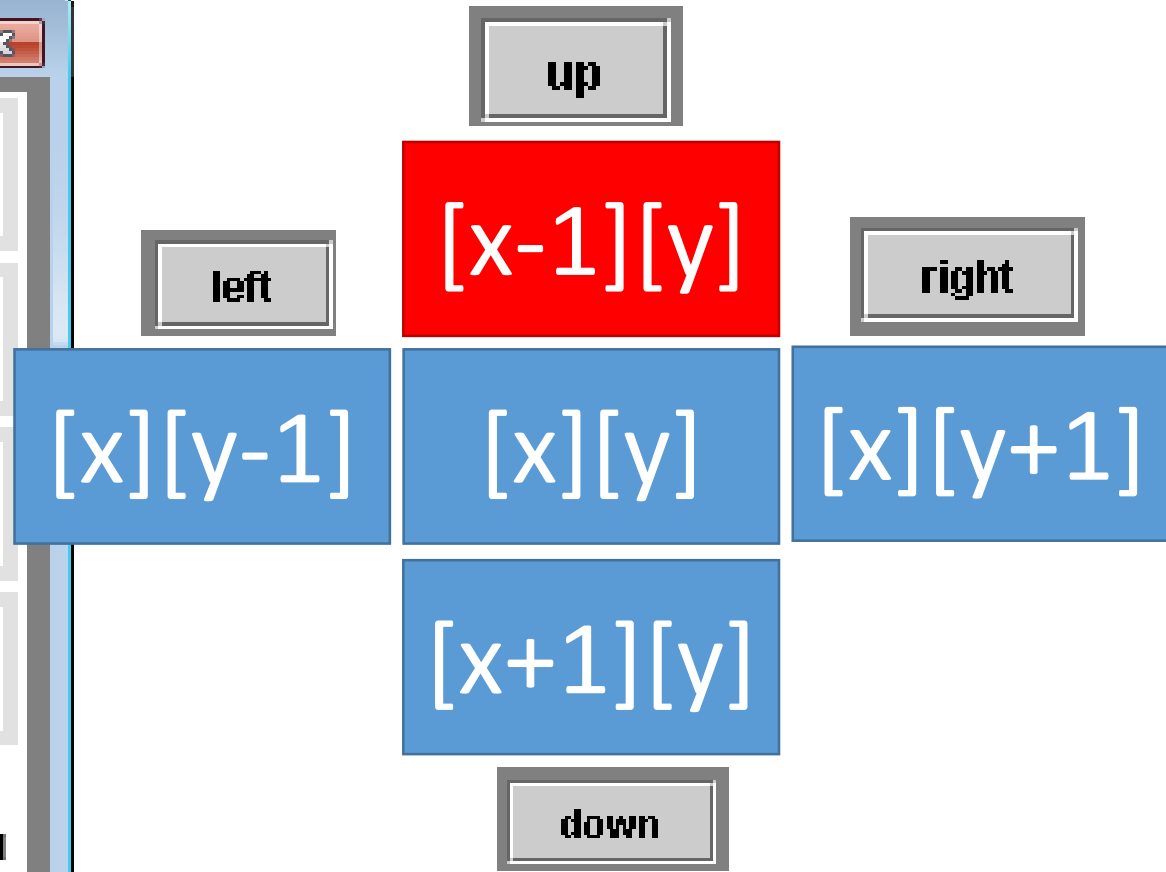
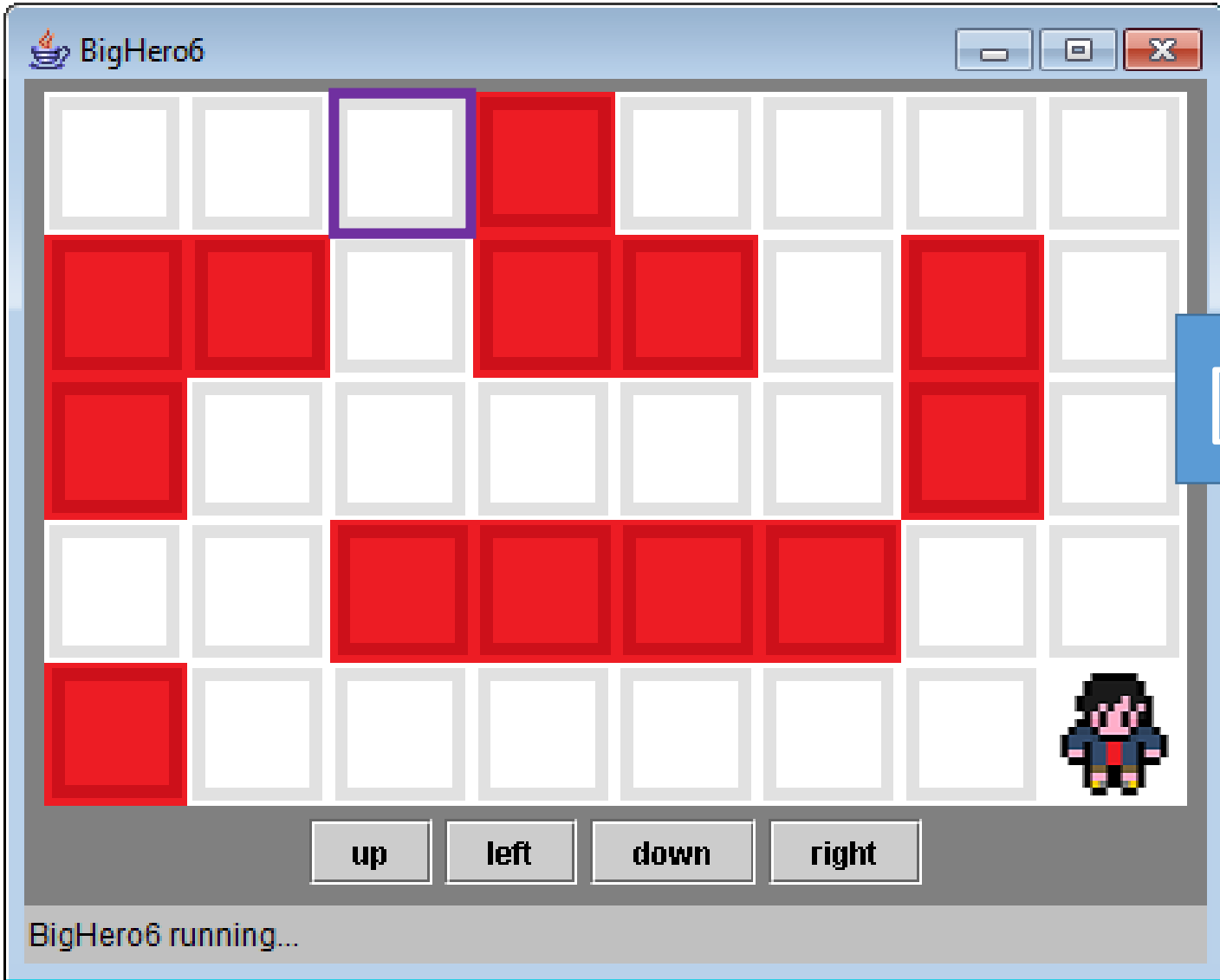
$[x][y]=[1][2]$

```

{ showStatus ("OK! Moving up.");
  pics [x * col + y].setIcon (createImageIcon ("bh4.png"));
  x--;
  pics [x * col + y].setIcon (createImageIcon ("bh1.png"));
}

```



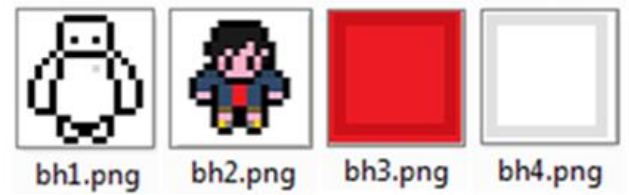


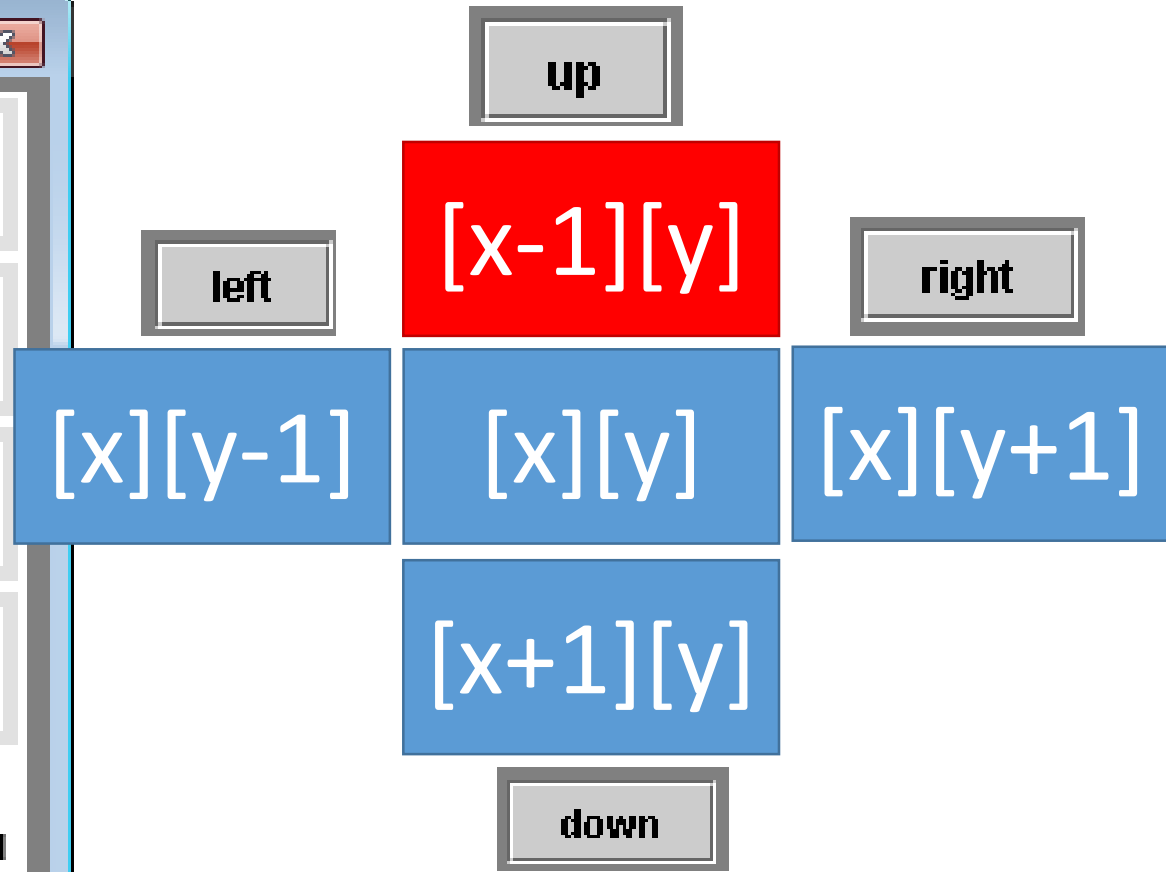
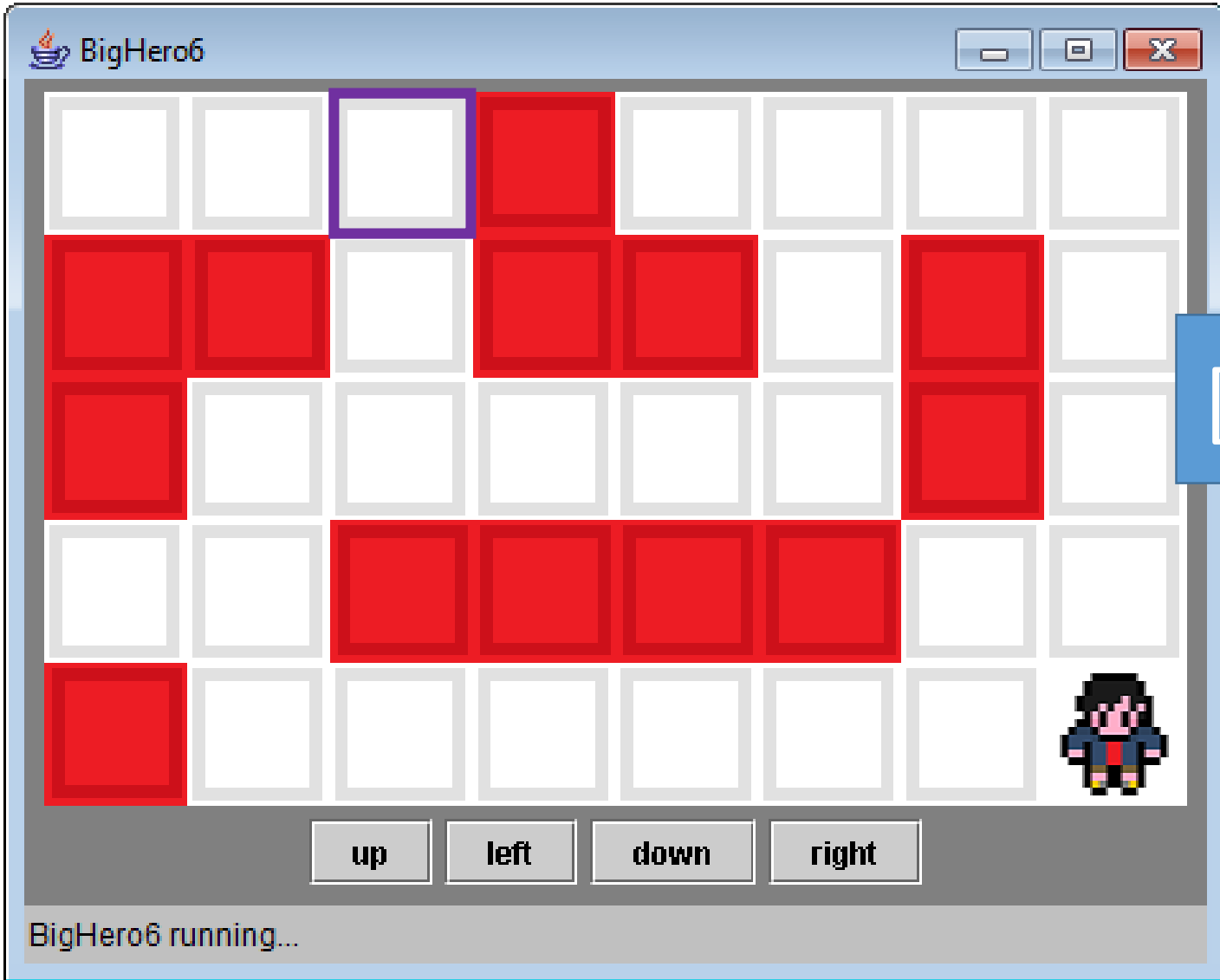
$[x][y]=[1][2]$

```

{ showStatus ("OK! Moving up.");
  pics [x * col + y].setIcon (createImageIcon ("bh4.png"));
  x--;
  pics [x * col + y].setIcon (createImageIcon ("bh1.png"));
}

```



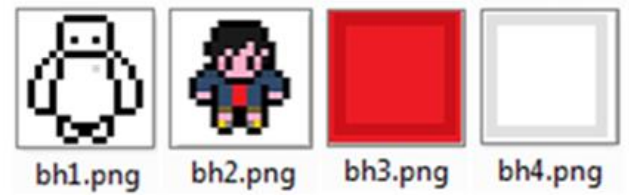


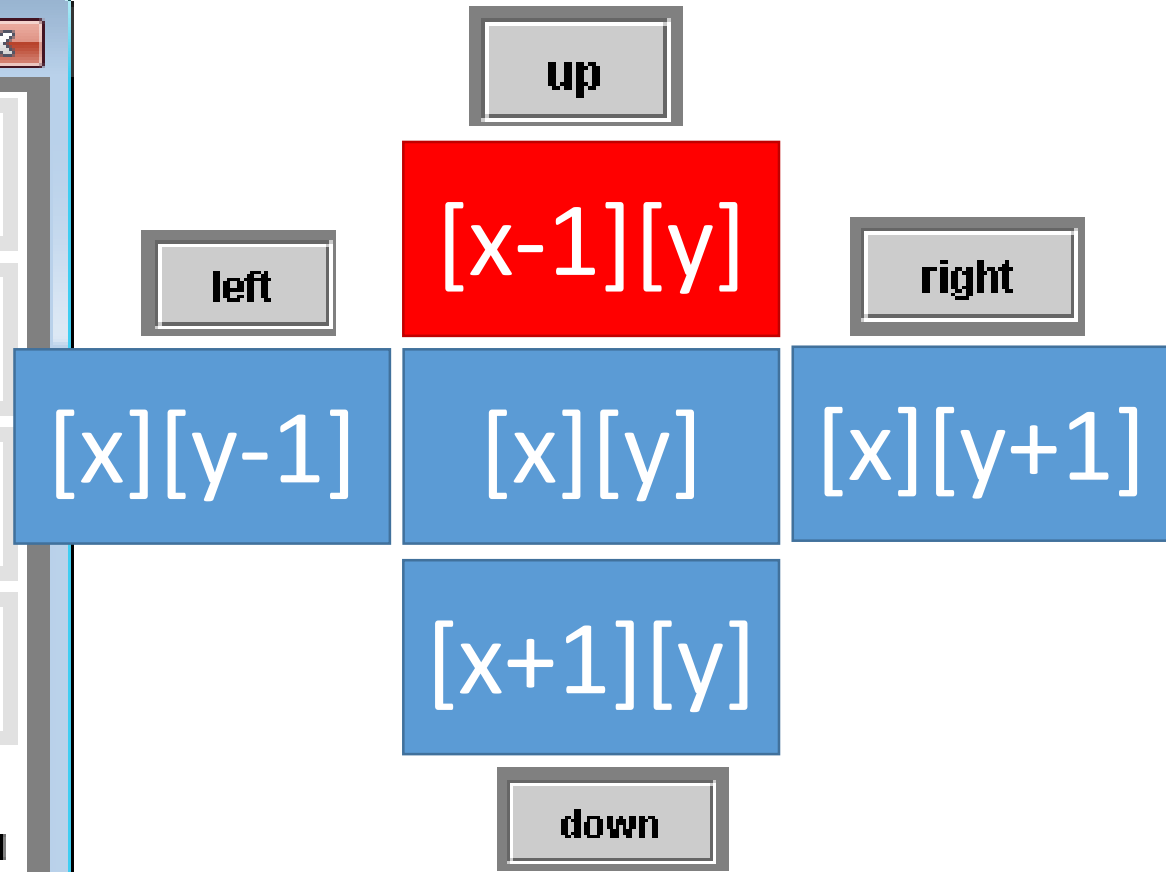
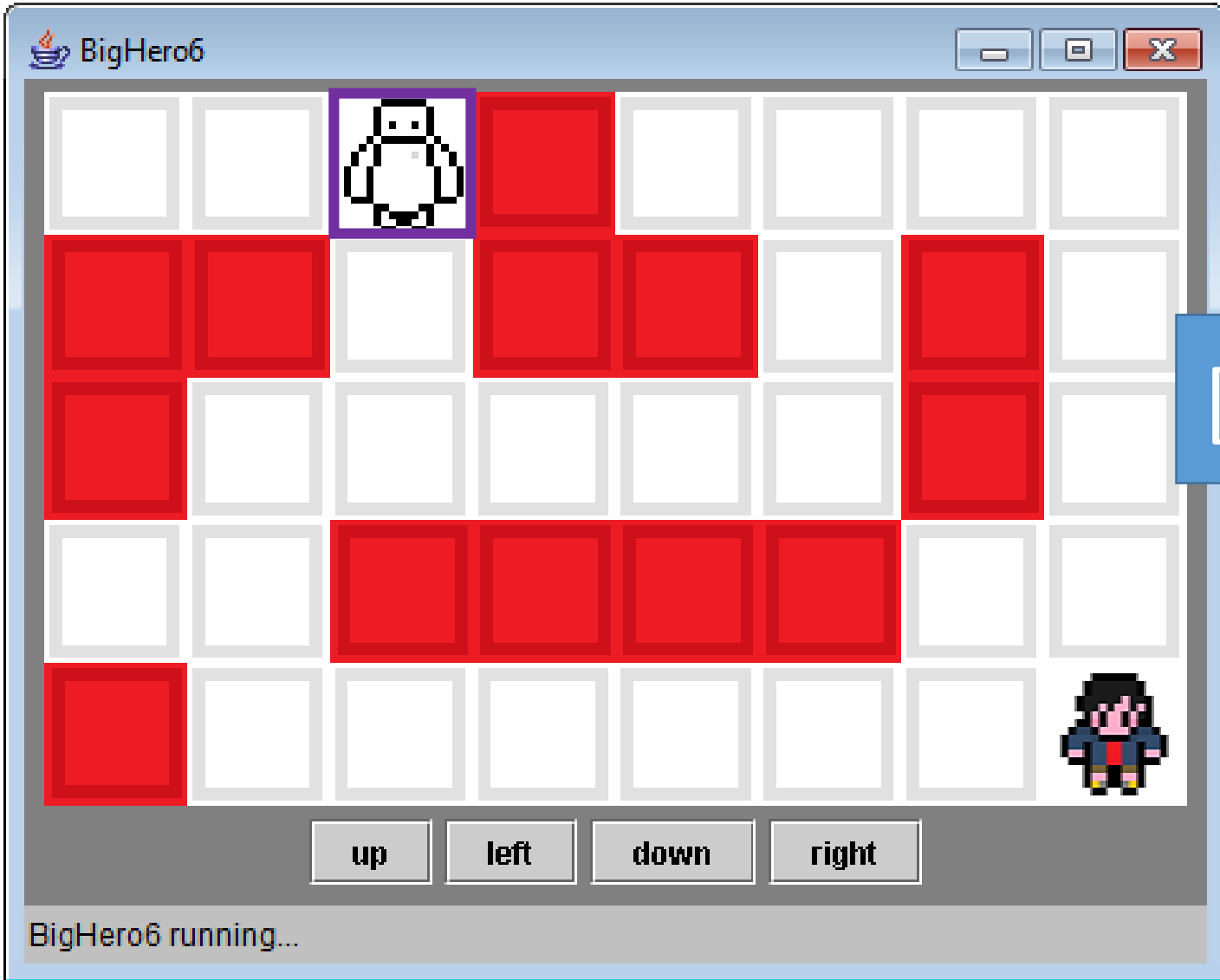
$[x][y]=[0][2]$

```

{ showStatus ("OK! Moving up.");
  pics [x * col + y].setIcon (createImageIcon ("bh4.png"));
  x--;
  pics [x * col + y].setIcon (createImageIcon ("bh1.png"));
}

```



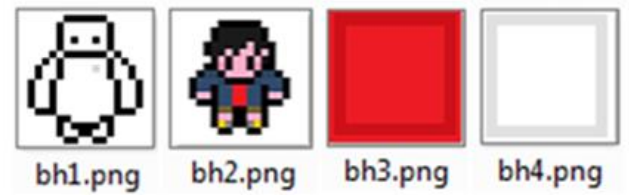


$[x][y]=[0][2]$

```

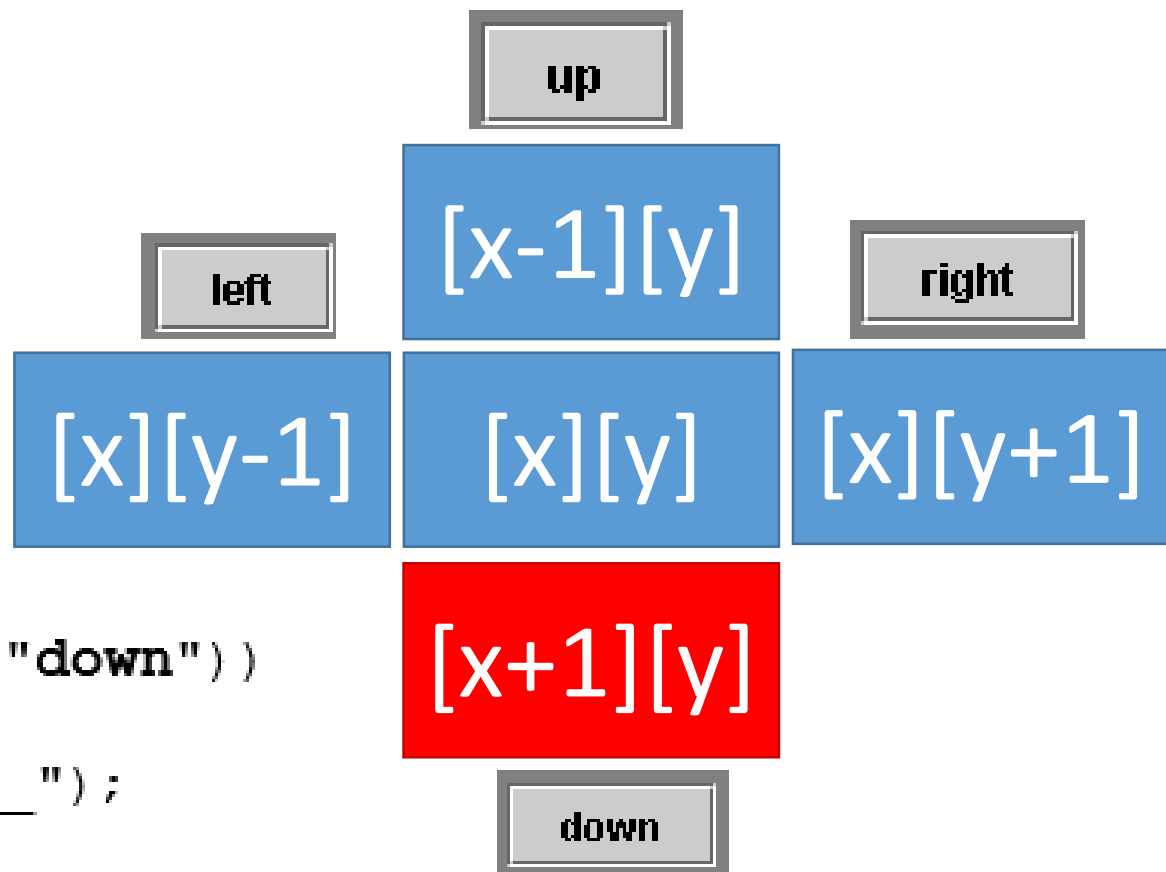
{ showStatus ("OK! Moving up.");
  pics [x * col + y].setIcon (createImageIcon ("bh4.png"));
  x--;
  pics [x * col + y].setIcon (createImageIcon ("bh1.png"));
}

```



Moving Down

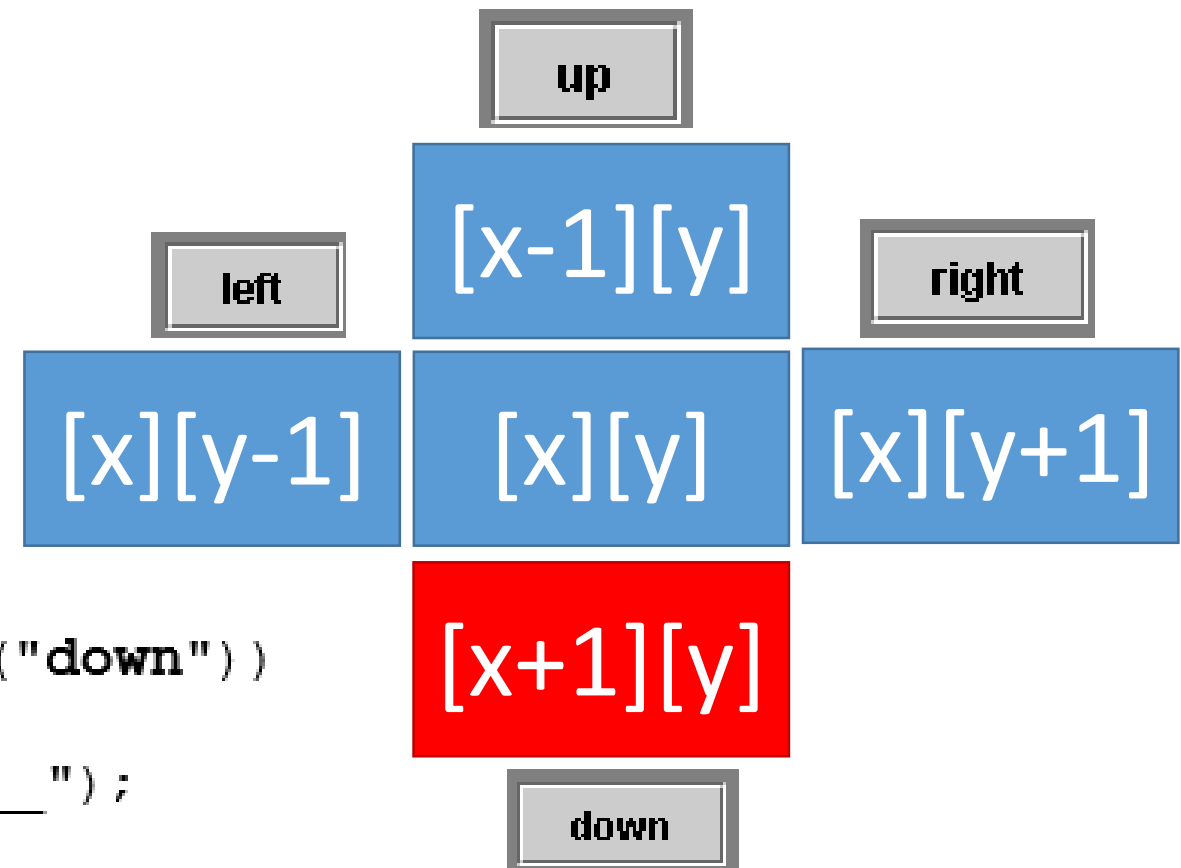
- Edge guard: $x+1 \geq \text{row}$, have fallen off the board.
- Check in spot $[x+1][y]$
- $x++$ to adjust position



```

else if (e.getActionCommand ().equals ("down"))
{ if (x _____ >= row)
  showStatus ("_____");
  else if (hero [_____] [y] != 4)
  showStatus ("There is a wall.");
  else
  { showStatus ("OK! _____.");
    pics [x * col + y].setIcon (createImageIcon ("bh4.png"));
    _____;
    pics [x * col + y].setIcon (createImageIcon ("bh1.png"));
  }
}
}

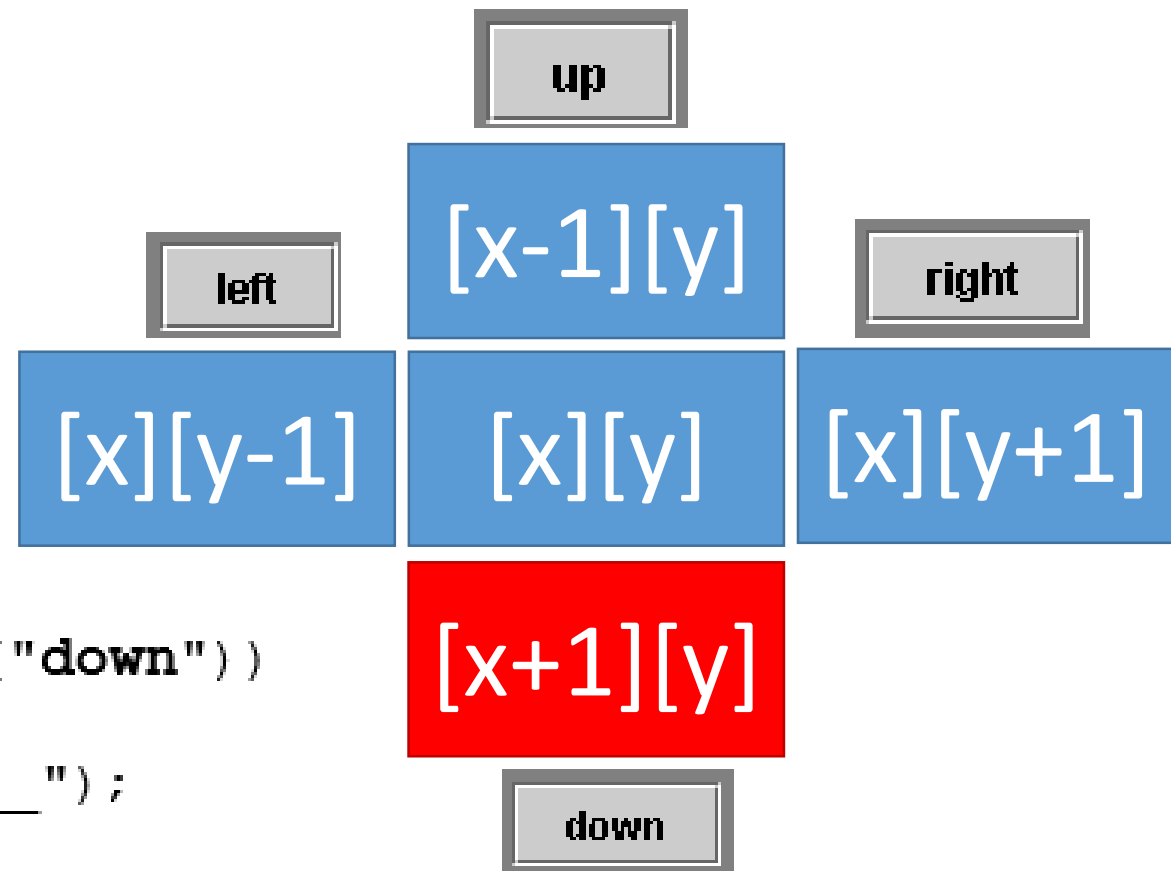
```



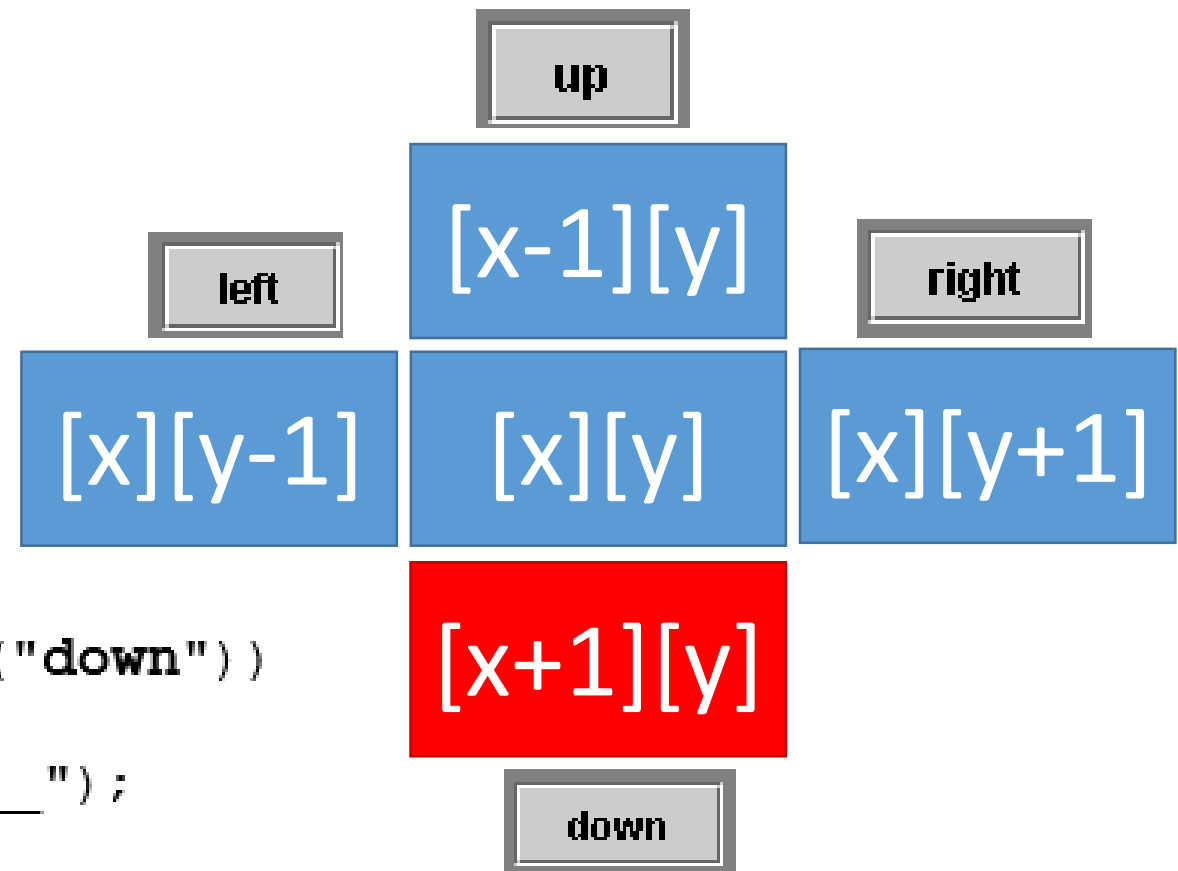
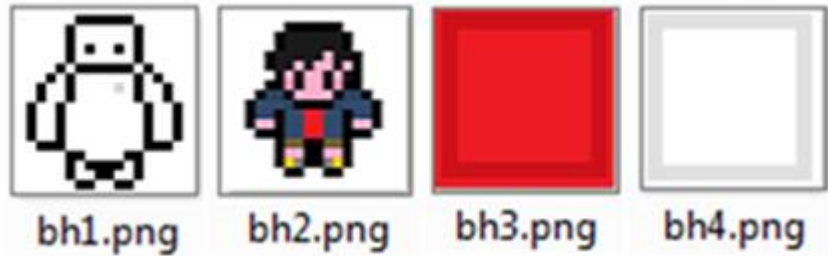
```

else if (e.getActionCommand ().equals ("down"))
{ if (x +1 >= row)
  showStatus ("Off the board!!!");
else if (hero [ ] [y] != 4)
  showStatus ("There is a wall.");
else
{ showStatus ("OK! .");
  pics [x * col + y].setIcon (createImageIcon ("bh4.png"));
  pics [x * col + y].setIcon (createImageIcon ("bh1.png"));
}
}
}

```



```
else if (e.getActionCommand ().equals ("down"))  
{ if (x +1 >= row)  
    showStatus (" Off the board!!!");  
else if (hero [x+1] [y] != 4)  
    showStatus ("There is a wall.");  
else  
{ showStatus ("OK! .");  
  pics [x * col + y].setIcon (createImageIcon ("bh4.png"));  
  _____;  
  pics [x * col + y].setIcon (createImageIcon ("bh1.png"));  
}  
}
```



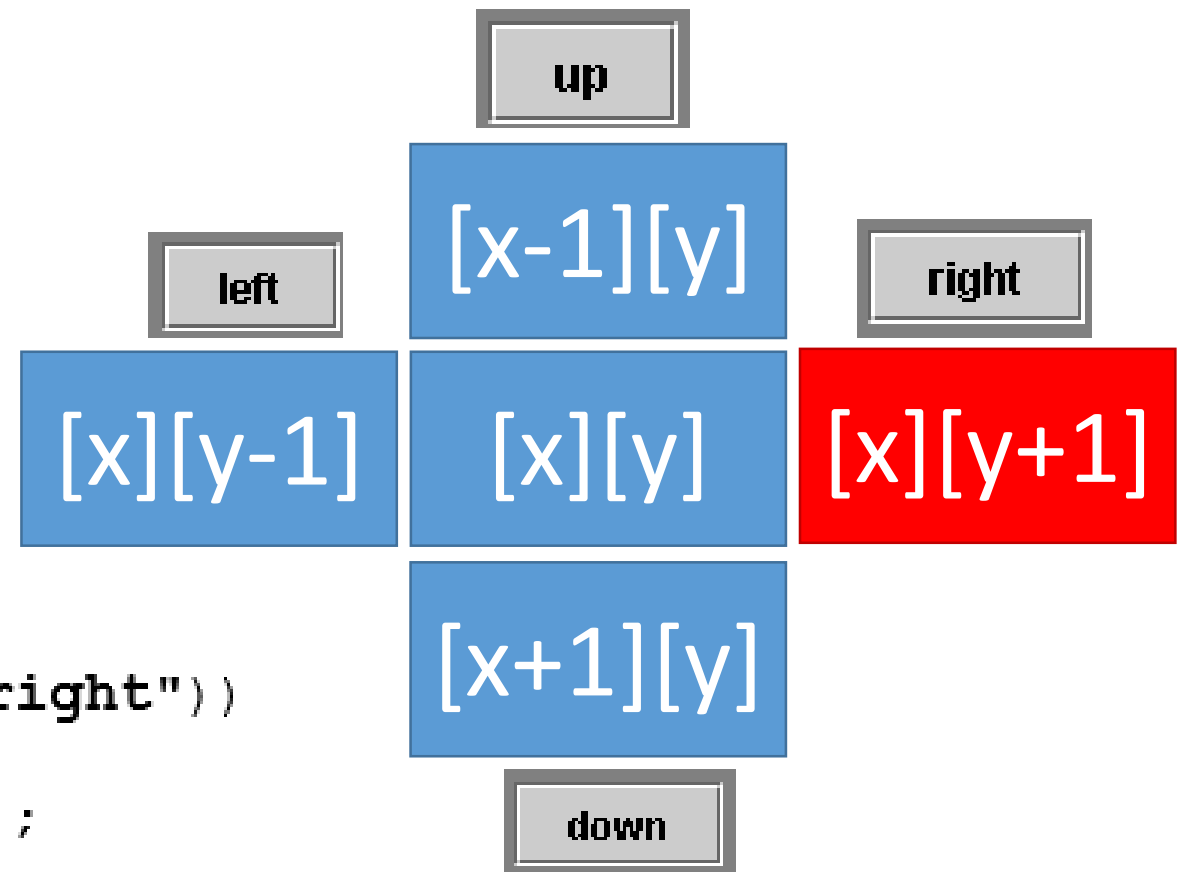
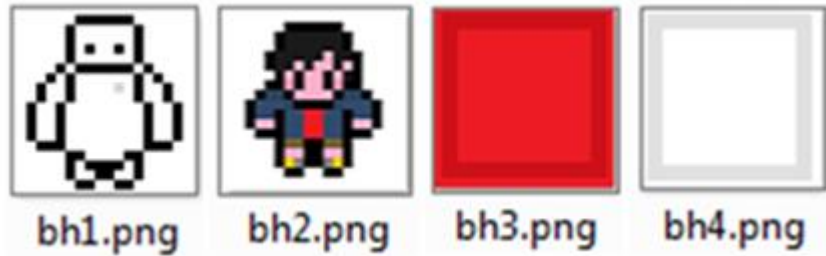
```

else if (e.getActionCommand ().equals ("down"))
{ if (x +1 >= row)
    showStatus ("Off the board!!!");
else if (hero [x+1] [y] != 4)
    showStatus ("There is a wall.");
else
{ showStatus ("OK! Moving Down.");
  pics [x * col + y].setIcon (createImageIcon ("bh4.png"));
  x++;
  pics [x * col + y].setIcon (createImageIcon ("bh1.png"));
}
}
}

```

Moving Right

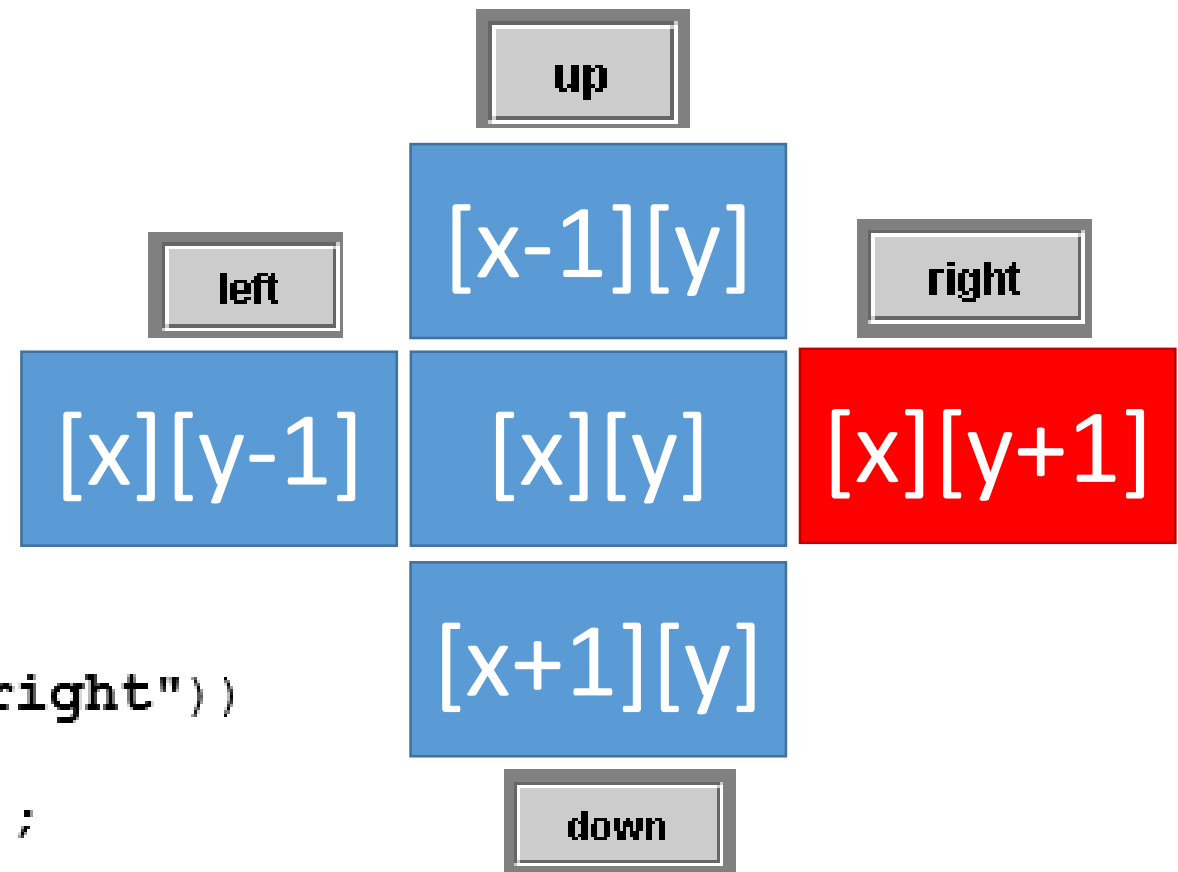
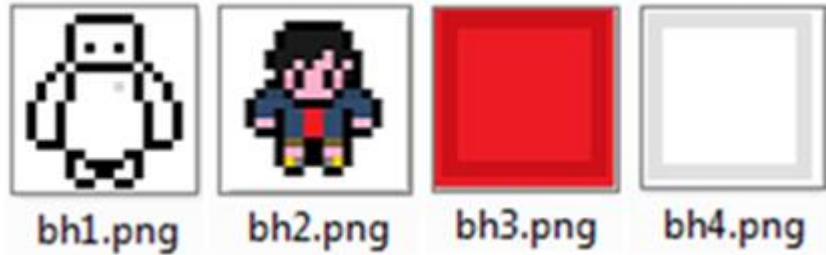
- Edge guard: $y+1 \geq \text{col}$, have fallen off the board.
- Check in spot $[x][y+1]$
- $y++$ to adjust position



```

else if (e.getActionCommand ().equals ("right"))
{ if (y + 1 >= col)
    showStatus ("_____");
  else if (hero [x] [y + 1] != 4)
    showStatus ("_____");
  else
  { showStatus ("OK! _____.");
    pics [x * col + y].setIcon (createImageIcon ("bh4.png"));
    _____;
    pics [x * col + y].setIcon (createImageIcon ("bh1.png"));
  }
}
}

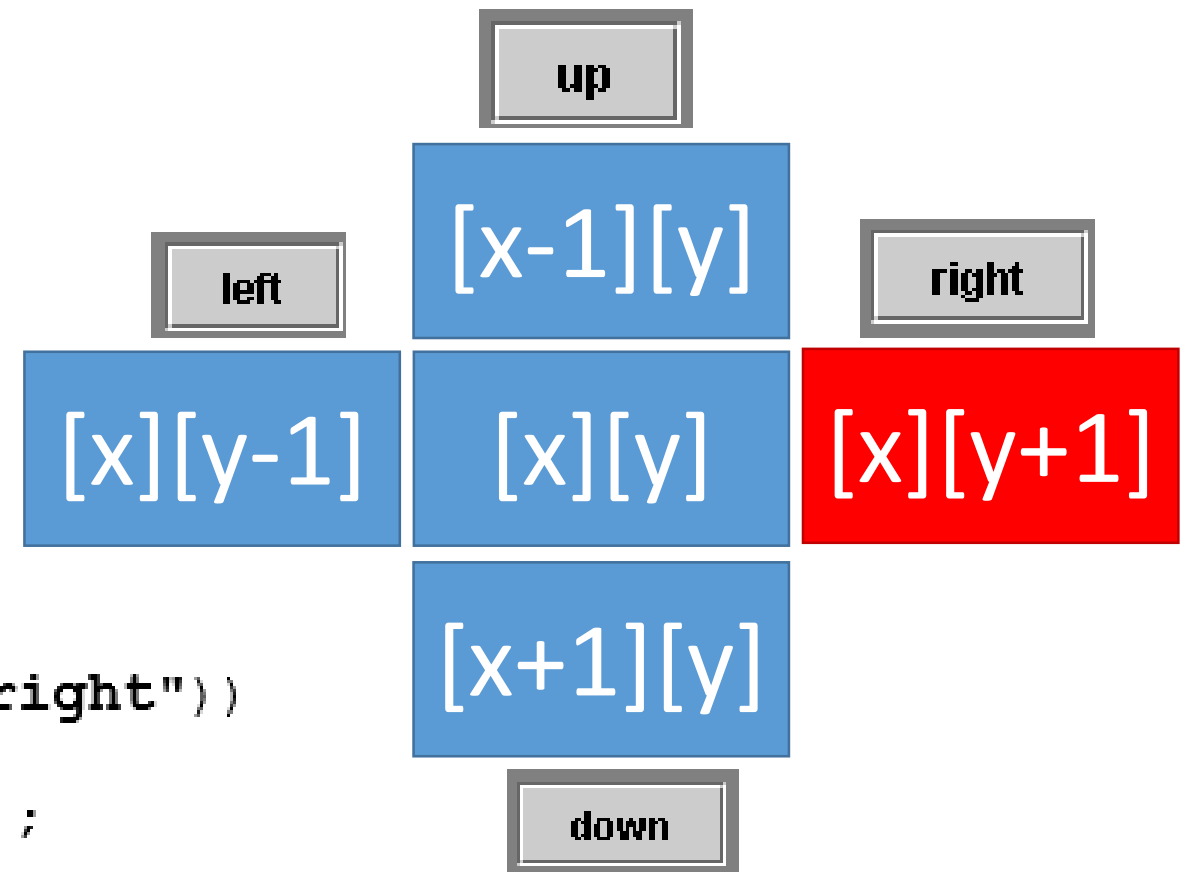
```



```

else if (e.getActionCommand ().equals ("right"))
{ if (y + 1 >= col)
  showStatus ("Off the board!!!");
else if (hero [x] [y + 1] != 4)
  showStatus ("");
else
{ showStatus ("OK! _____.");
  pics [x * col + y].setIcon (createImageIcon ("bh4.png"));
  _____;
  pics [x * col + y].setIcon (createImageIcon ("bh1.png"));
}
}
}

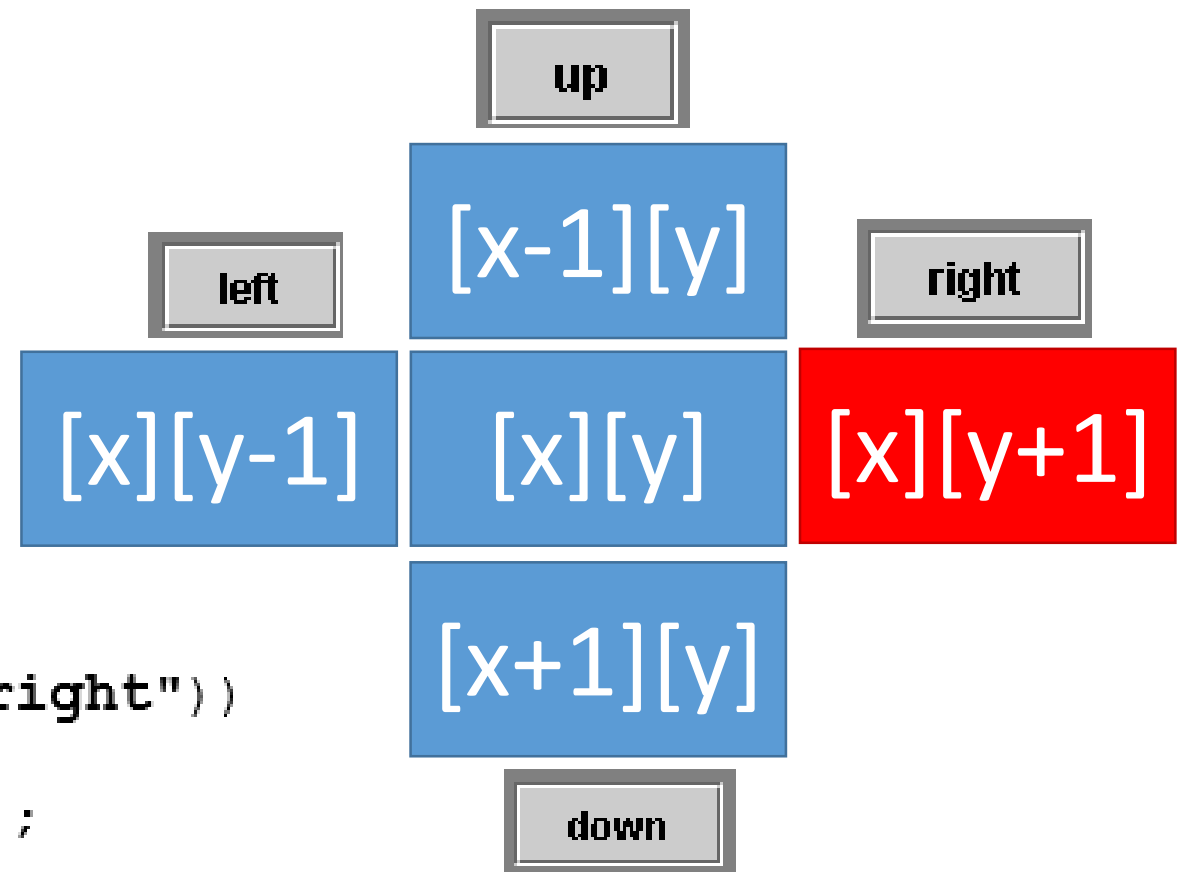
```



```

else if (e.getActionCommand ().equals ("right"))
{ if (y + 1 >= col)
    showStatus ("Off the board!!!");
  else if (hero [x] [y + 1] != 4)
    showStatus ("There is a wall");
  else
  { showStatus ("OK! _____.");
    pics [x * col + y].setIcon (createImageIcon ("bh4.png"));
    _____;
    pics [x * col + y].setIcon (createImageIcon ("bh1.png"));
  }
}

```

```

else if (e.getActionCommand ().equals ("right"))
{ if (y + 1 >= col)
  showStatus ("Off the board!!!");
else if (hero [x] [y + 1] != 4)
  showStatus ("There is a wall");
else
{ showStatus ("OK! Moving Right.");
  pics [x * col + y].setIcon (createImageIcon ("bh4.png"));
  y++;
  pics [x * col + y].setIcon (createImageIcon ("bh1.png"));
}
}
}

```