



AP[®] Computer Science A 2003 Sample Student Responses

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- (a) Write the `TreasureMap` member function `HasTreasure`, which is described as follows. `HasTreasure` returns `true` if there is a treasure at the location `(row, col)`. If `(row, col)` is not within the bounds of the grid or if there is no treasure at that location, `HasTreasure` returns `false`.

For example, if `TreasureMap` `theMap` represents the treasure map shown at the beginning of the question, the following table gives the results of several calls to `HasTreasure`.

<u>Function call</u>	<u>Value returned</u>
<code>theMap.HasTreasure(0, 2)</code>	<code>true</code>
<code>theMap.HasTreasure(0, -1)</code>	<code>false</code>
<code>theMap.HasTreasure(2, 3)</code>	<code>true</code>
<code>theMap.HasTreasure(2, 2)</code>	<code>false</code>
<code>theMap.HasTreasure(4, 9)</code>	<code>false</code>

Complete function `HasTreasure` below.

```
bool TreasureMap::HasTreasure(int row, int col) const
// postcondition: returns true if the cell at location (row, col)
//                contains a treasure;
//                returns false if location (row, col) is not within
//                the bounds of the grid or if there is no treasure
//                at that location
{
    if ((row < 0 || row >= NumRows()) || (col < 0 || col >= NumCols()))
        return false;
    return myGrid[row][col];
}
```

Part (b) begins on page 14.

GO ON TO THE NEXT PAGE.

Complete function NumAdjacent below.

```
int TreasureMap::NumAdjacent(int row, int col) const
// precondition: 0 <= row < NumRows(); 0 <= col < NumCols()
// postcondition: returns a count of the number of treasures in the
//                cells adjacent to the location (row, col),
//                horizontally, vertically, and diagonally
{
    int r, c, numTreasure = 0;
    for (r = row - 1; r <= row + 1; r++)
    {
        for (c = col - 1; c <= col + 1; c++)
        {
            if (HasTreasure(r, c))
                numTreasure++;
        }
    }
    if (HasTreasure(row, col))
        numTreasure--;
    return numTreasure;
}
```

Part (c) begins on page 16.

GO ON TO THE NEXT PAGE.

Complete function ComputeCounts below.

```
apmatrix<int> ComputeCounts(const TreasureMap & theMap)
{
    apmatrix<int> newMap (theMap.NumRows(), theMap.NumCols());
    int r, c;
    for (r = 0; r < newMap.numrows(); r++)
    {
        for (c = 0; c < newMap.numcols(); c++)
        {
            if (theMap.HasTreasure(r, c))
                newMap[r][c] = 1;
            else
                newMap[r][c] = theMap.NumAdjacent(r, c);
        }
    }
    return newMap;
}
```

GO ON TO THE NEXT PAGE.

- (a) Write the `TreasureMap` member function `HasTreasure`, which is described as follows. `HasTreasure` returns `true` if there is a treasure at the location `(row, col)`. If `(row, col)` is not within the bounds of the grid or if there is no treasure at that location, `HasTreasure` returns `false`.

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<code>theMap.HasTreasure(2, 3)</code>	<code>true</code>
<code>theMap.HasTreasure(2, 2)</code>	<code>false</code>
<code>theMap.HasTreasure(4, 9)</code>	<code>false</code>

Complete function `HasTreasure` below.

```

bool TreasureMap::HasTreasure(int row, int col) const
// postcondition: returns true if the cell at location (row, col)
//                contains a treasure;
//                returns false if location (row, col) is not within
//                the bounds of the grid or if there is no treasure
//                at that location
{
    if ((row >= 0) && (row < myGrid.NUMROWS()) && (col >= 0)
        && (col < myGrid.NUMCOLS()) && (myGrid[row][col] == TRUE)
        RETURN TRUE;
    }
    else {
        RETURN false;
    }
}

```

Part (b) begins on page 14.

GO ON TO THE NEXT PAGE.

Complete function NumAdjacent below.

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// postcondition: returns a count of the number of treasures in the
//                cells adjacent to the location (row, col),
//                horizontally, vertically, and diagonally
```

```
{
    int counter = 0;
    if (HasTreasure(row+1, col))
        counter++;
    if (HasTreasure(row-1, col))
        counter++;
    if (HasTreasure(row, col+1))
        counter++;
    if (HasTreasure(row, col-1))
        counter++;
    if (HasTreasure(row+1, col+1))
        counter++;
    if (HasTreasure(row-1, col-1))
        counter++;
    if (HasTreasure(row+1, col-1))
        counter++;
    if (HasTreasure(row-1, col+1))
        counter++;
    return counter;
}
```

Part (c) begins on page 16.

GO ON TO THE NEXT PAGE.

Complete function ComputeCounts below.

```
apmatrix<int> ComputeCounts(const TreasureMap & theMap)
```

```
{  
    apmatrix<int> mines(theMap.NumRows(), theMap.NumCols())  
    // REMINDS ME OF MINESWEEPER!  
    for (int row = 0; row < mines.NumRows(); row++) {  
        for (int col = 0; col < mines.NumCols(); col++) {  
            if (theMap.HasTreasure(row, col)) {  
                mines[row][col] = 9;  
            }  
            else {  
                mines[row][col] = theMap.NumAdjacent(row, col);  
            }  
        }  
    }  
    return mines;  
}
```

GO ON TO THE NEXT PAGE.

- (a) Write the `TreasureMap` member function `HasTreasure`, which is described as follows. `HasTreasure` returns `true` if there is a treasure at the location `(row, col)`. If `(row, col)` is not within the bounds of the grid or if there is no treasure at that location, `HasTreasure` returns `false`.

For example, if `TreasureMap` `theMap` represents the treasure map shown at the beginning of the question, the following table gives the results of several calls to `HasTreasure`.

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<code>theMap.HasTreasure(2, 2)</code>	<code>false</code>
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Complete function `HasTreasure` below.

```

bool TreasureMap::HasTreasure(int row, int col) const
// postcondition: returns true if the cell at location (row, col)
//                contains a treasure;
//                returns false if location (row, col) is not within
//                the bounds of the grid or if there is no treasure
//                at that location
{
    if (theMap.myGrid[row][col] == True)
        return True;
    else
        return False;
}

```

Part (b) begins on page 14.

GO ON TO THE NEXT PAGE.

Complete function NumAdjacent below.

```
int TreasureMap::NumAdjacent(int row, int col) const
// precondition: 0 <= row < NumRows(); 0 <= col < NumCols()
// postcondition: returns a count of the number of treasures in the
//                cells adjacent to the location (row, col),
//                horizontally, vertically, and diagonally
```

```
{
    int counter = 0;

    if (theMap.myGrid[row+1][col] == True)
        counter++;

    if (theMap.myGrid[row+1][col+1] == True)
        counter++;

    if (theMap.myGrid[row+1][col-1] == True)
        counter++;

    if (theMap.myGrid[row][col-1] == True)
        counter++;

    if (theMap.myGrid[row][col+1] == True)
        counter++;

    if (theMap.myGrid[row-1][col] == True)
        counter++;

    if (theMap.myGrid[row-1][col+1] == True)
        counter++;

    if (theMap.myGrid[row-1][col-1] == True)
        counter++;

    return counter;
}
```

Part (c) begins on page 16.

GO ON TO THE NEXT PAGE.

Complete function ComputeCounts below.

```
apmatrix<int> ComputeCounts(const TreasureMap & theMap)
```

```
{ apmatrix<int> Solution (theMap.NumRows(), theMap.NumCols());  
  for (int a=0; a < theMap.NumRows(); a++)  
    for (int b=0; b < theMap.NumCols(); b++)  
      {  
        if (theMap.HasTreasure(a,b) == True)  
          Solution[a][b] = 9;  
        else  
          Solution[a][b] = theMap.NumAdjacent(a,b);  
      }  
  return Solution;  
}
```

GO ON TO THE NEXT PAGE.