AP Computer Science A
1999 Sample Student Responses

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(a) Write the code for the constructor that initializes a quilt, as started below. The constructor reads the block pattern for the main block from a file represented by the parameter `inFile`. You may assume the file is open and that the file contains the number of rows followed by the number of columns for the block, followed by the characters representing the pattern. For example, the file `pattern`, which contains the pattern for the first block in the quilt shown above, would look like this:

```
4 5
x...x
.x.x.
..x..
..x..
```

The constructor also sets the number of rows and columns of blocks which make up the entire quilt in the initializer list.

Complete the constructor below. Assume that the constructor is called only with parameters that satisfy its precondition.

```
Quilt::Quilt(istream & inFile, int rowsOfBlocks, int colsOfBlocks)
  : myBlock(0, 0), myRowsOfBlocks(rowsOfBlocks),
    myColsOfBlocks(colsOfBlocks)
// precondition:  inFile is open, rowsOfBlocks > 0, colsOfBlocks > 0
// postcondition: myRowsOfBlocks and myColsOfBlocks are initialized to
//                the number of rows and columns of blocks that make up
//                the quilt; myBlock has been resized and
//                initialized to the block pattern from the
//                stream inFile.
  {
    int row, col;
    inFile >> row >> col;
    myBlock.resize(row, col);
    char x;
    for(int i=0; i<row; i++)
      for(int k=0; k<col; k++)
        {
          inFile >> x;
          myBlock[i][k]=x;
        }
  }
```

Part (b) begins on page 6.

Complete the member function `PlaceFlipped` below. Assume that `PlaceFlipped` is called only with parameters that satisfy its precondition.

```
void Quilt::PlaceFlipped(int startRow, int startCol,
                         apmatrix<char> & qmat)
// precondition:  startRow ≥ 0; startCol ≥ 0;
//                startRow + myBlock.numrows() ≤ qmat.numrows();
//                startCol + myBlock.numcols() ≤ qmat.numcols();
// postcondition: a flipped version of myBlock has been copied into the
//                matrix qmat with its upper-left corner at the position
//                startRow, startCol
{
  int r, c;

  for (r = 0; r < myBlock.numrows(); r++)
  {
    for (c = 0; c < myBlock.numcols(); c++)
    {
      qmat[startRow + r][startCol + c] = myBlock[myBlock.numrows()-r-1][c];
    }
  }
}
```

Part (c) begins on page 8.

(c) Write the member function `QuiltToMat`, as started below. `QuiltToMat` returns a matrix representing the whole quilt in such a way that the main block alternates with the flipped version of the main block, as shown in the original example. If `Q` represents the example quilt, then the call `Q.QuiltToMat()` would return a matrix of characters with the given block placed starting with the upper-left corner at position 0, 0; the flipped block placed with its upper-left corner at position 0, 5; the given block placed with its upper-left corner at position 0, 10; the flipped block placed with its upper-left corner at position 4, 0, and so on.

In writing `QuiltToMat`, you may call functions `PlaceBlock` and `PlaceFlipped` specified in part (b). Assume that `PlaceBlock` and `PlaceFlipped` work as specified, regardless of what you wrote in part (b).

Complete the member function `QuiltToMat` below.

```
apmatrix<char> Quilt::QuiltToMat()
  {
    apmatrix<char> mat(myBlock.numrows() * myRowsOfBlocks,
                       myBlock.numcols() * myColsOfBlocks);
    for(int K=0; K < myRowsOfBlocks; K++)
      for(int P=0; P<myColsOfBlocks; P++)
        {
          if((K+P)%2==0)
            {
              PlaceBlock(K*myBlock.numrows(), P*myBlock.numcols(), m
            }
          else
            PlaceFlipped(K*myBlock.numrows(), P*myBlock.numcols(), mat,
        }
    return mat;
  }
```

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   : myBlock(0, 0), myRowsOfBlocks(rowsOfBlocks),
     myColsOfBlocks(colsOfBlocks)
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// postcondition: myRowsOfBlocks and myColsOfBlocks are initialized to
//                the number of rows and columns of blocks that make up
//                the quilt; myBlock has been resized and
//                initialized to the block pattern from the
//                stream inFile.
{ int rows, cols;
  char let;
  inFile >> rows;
  inFile >> cols;
  myBlock.resize (rows, cols);
  for (int i=0; i<rows; i++)
  {
    for (int j=0; j<cols; j++)
    {
      inFile >> let;
      myBlock[i][j] = let;
    }
  }
}
```

Part (b) begins on page 14.

Complete the member function `PlaceFlipped` below. Assume that `PlaceFlipped` is called only with parameters that satisfy its precondition.

```
void Quilt::PlaceFlipped(int startRow, int startCol,
                         apmatrix<char> & qmat)
// precondition:  startRow ≥ 0; startCol ≥ 0;
//                startRow + myBlock.numrows() ≤ qmat.numrows();
//                startCol + myBlock.numcols() ≤ qmat.numcols();
// postcondition: a flipped version of myBlock has been copied into the
//                matrix qmat with its upper-left corner at the position
//                startRow, startCol
{
  int r, c;

  for (r = 0; r < myBlock.numrows(); r++)
  {
    for (c = 0; c < myBlock.numcols(); c++)
    {
      qmat[startRow+r][startCol+c] = myBlock[myBlock.numrows()-1-r][myBlock.numcols()-1-c];

    }
  }
}
```

Part (c) begins on page 16.

(c) Write the member function `QuiltToMat`, as started below. `QuiltToMat` returns a matrix representing the whole quilt in such a way that the main block alternates with the flipped version of the main block, as shown in the original example. If `Q` represents the example quilt, then the call `Q.QuiltToMat()` would return a matrix of characters with the given block placed starting with the upper-left corner at position 0, 0; the flipped block placed with its upper-left corner at position 0, 5; the given block placed with its upper-left corner at position 0, 10; the flipped block placed with its upper-left corner at position 4, 0, and so on.

In writing `QuiltToMat`, you may call functions `PlaceBlock` and `PlaceFlipped` specified in part (b). Assume that `PlaceBlock` and `PlaceFlipped` work as specified, regardless of what you wrote in part (b).

Complete the member function `QuiltToMat` below.

```
apmatrix<char> Quilt::QuiltToMat()
{
  bool switch=true;
  for(int i = 0; i< myRowsofBlocks ; i++)
  {
    for(int j=0; j<myColsOfBlocks; j++)
    {
      if (switch)
        PlaceBlock (myBlock.numrows() * i , myBlock.numcols() * j, *this);
      else
        PlaceFlipped (myBlock.numrows()*i, myBlock.numcols()*j, *this);

      switch = !switch;
    }
  }
}
```

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    myColsOfBlocks(colsOfBlocks)
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// postcondition: myRowsOfBlocks and myColsOfBlocks are initialized to
//                the number of rows and columns of blocks that make up
//                the quilt; myBlock has been resized and
//                initialized to the block pattern from the
//                stream inFile.
int row, col;
for (int lcv=0; lcv < rowsOfBlocks; lcv++)
{
  for (int lcv2= 0; lcv2< colsOfBlocks; lcv2++)
  {
    infile >> row;
    infile >> col;
    for (int lcv3=0; lcv3< rows; lcv3++)
    {
      for (int lcv4=0; lcv4<cols; lcv4++)
      {
        inFile >> myBlock[lcv][lcv2][lcv3][lcv4];
      }
    }
  }
}
```

Part (b) begins on page 14.

Complete the member function `PlaceFlipped` below. Assume that `PlaceFlipped` is called only with parameters that satisfy its precondition.

```
void Quilt::PlaceFlipped(int startRow, int startCol,
                         apmatrix<char> & qmat)
// precondition:  startRow ≥ 0; startCol ≥ 0;
//                startRow + myBlock.numrows() ≤ qmat.numrows();
//                startCol + myBlock.numcols() ≤ qmat.numcols();
// postcondition: a flipped version of myBlock has been copied into the
//                matrix qmat with its upper-left corner at the position
//                startRow, startCol
{
  int r, c;

  for (r = 0; r < myBlock.numrows(); r++)
  {
    for (c = 0; c < myBlock.numcols(); c++)
    {  qmat[startRow + myBlock.numrows() - r][startCol + c] = myBlock[r][c]

    }
  }
}
```

Part (c) begins on page 16.

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In writing `QuiltToMat`, you may call functions `PlaceBlock` and `PlaceFlipped` specified in part (b). Assume that `PlaceBlock` and `PlaceFlipped` work as specified, regardless of what you wrote in part (b).

Complete the member function `QuiltToMat` below.

```
apmatrix<char> Quilt::QuiltToMat()
PlaceBlock(0,0, M);
 PlaceFlipped(0,5,M);
Place Block(0,10, M);
 PlaceFlipped(4,0, M);
 PlaceBlock(4,5, M);
 PlaceFlipped(4,10,M);
 PlaceBlock(8,0,M);
  PlaceFlipped(8,5,M);
   PlaceBlock(8,10,M);
```

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