CPSC 5031 Homework 6

Visualizing Graphs

Name: David Nguyen

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| Description |
| Write a program that can take an adjacencymatrixfile and generate a GraphViz “dot file”. Run the dot files through dot(one of the GraphViz command line tools) and generate a PNG file. |

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| Summary after completed the homework |
| It is a great way to build a graph using GraphViz and it is even more fun to build a tool in my own favorite language to implement this GraphViz API.  I started using MS-Test to add test cases for my program. One lesson I have learned, that the more test cases I added, the more updates I need to add into my function/methods. Clearly, adding test cases is a great way to see what are you missing in your function and discover the bugs at very early stage.  After finishing this homework, I also discovery some develop already built Nuget package that I can use for real application in the future. |

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| Assumption to run this tool |
| 1. Maximum of nodes for a graph is 24 (starting with letter A to Z) 2. Required user to provide text file and its location 3. Tool only run on Windows OS |

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| **Source code** |
| <https://github.com/davednguyen/cpsc5031_hw6.git> |
| **Branch** |
| Develop |
| Main code project name: cpsc5031\_hw6 |
| Test codes project name: GraphVizTestProject |

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| Total test cases: 24 | | |
| Test framework: MS Test | | |
| Language: C3 | | |
| Test case name | Expected result | Actual result |
| TestCase\_4by4Matrix\_1\_HappyPath\_Graph | True | True |
| TestCase\_4by4Matrix\_2\_HappyPath\_Graph | True | True |
| TestCase\_5by5Matrix\_1\_HappyPath\_Graph | True | True |
| TestCase\_6by6Matrix\_1\_HappyPath\_Graph | True | True |
| TestCase\_4by4Matrix\_1\_HappyPath\_Digraph | True | True |
| TestCase\_4by4Matrix\_2\_HappyPath\_Digraph | True | True |
| TestCase\_5by5Matrix\_1\_HappyPath\_Digraph | True | True |
| TestCase\_6by6Matrix\_1\_HappyPath\_Digraph | True | True |
| TestCase\_Check\_EmptyTextFile\_Graph | False | False |
| TestCase\_Check\_EmptyTextFile\_digraph | False | False |
| TestCase\_Check\_NoTextFileFoundInTheFolder\_Graph | False | False |
| TestCase\_Check\_NoTextFileFoundInTheFolder\_dgraph | False | False |
| TestCase\_Check\_TextFileHasSpecialCharactersMixWith\_0\_and\_1\_Graph | True | True |
| TestCase\_Check\_TextFileHasSpecialCharactersMixWith\_0\_and\_1\_dgraph | True | True |
| TestCase\_Check\_TextFileHasSpecialCharactersOnly\_Graph | True | True |
| TestCase\_Check\_TextFileHasSpecialCharactersOnly\_Dgraph | True | True |
| TestCase\_Check\_TextFileHas\_1\_Only\_Graph | True | True |
| TestCase\_Check\_TextFileHas\_1\_Only\_dgraph | True | True |
| TestCase\_Check\_TextFileHas\_0\_Only\_Graph | True | True |
| TestCase\_Check\_TextFileHas\_0\_Only\_dgraph | True | True |
| TestCase\_Check\_TextFileHas\_24\_nodes\_Graph | True | True |
| TestCase\_Check\_TextFileHas\_24\_nodes\_dgraph | True | True |
| TestCase\_Check\_TextFileHas\_25\_nodes\_Graph\_EdgeCase | True | True |
| TestCase\_Check\_TextFileHas\_25\_nodes\_dgraph\_EdgeCase | True | True |
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| Text files to test |
| Adj1.txt |
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| Adj2.txt |
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| Adj3.txt |
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| Adj4.txt |
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| Adj5.txt |
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| Adj6.txt |
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| Adj7.txt |
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| Adjt8.txt |
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| Adjt9.txt |
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| Adj24.txt |
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| Adj25.txt |
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| Images generated by the tools (after rand the test) please refer to github folder for all individual images. |
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| Main tool codes (for better view, please refer to text file attachment) best application to view C# codes is NodePad++ - (file name: MainToolCodesInCSharp.txt) |
| using System;  using System.Collections.Generic;  using System.Diagnostics;  using System.IO;  /// <summary>  /// Homework 6  /// developer: David Nguyen  /// </summary>  namespace cpsc5031\_hw6  {  public class Program  {  public static void Main(string[] args)  {  Console.WriteLine("Homework 6");  string directory = @"C:\Users\dzzn\Desktop\CPSC5031\_02\week8\homework6\files\";  //string directory = @"C:\Users\mr4eyesn\Desktop\CPSC5031\_2\week8\homework\code\cpsc5031\_hw6\files\";  //GraphVizGenerator("adj1.txt", "adj1.png", "adj1.dot", directory, false);  //GraphVizGenerator("adj2.txt", "adj2.png", "adj2.dot", directory, false);  //GraphVizGenerator("adj3.txt", "adj3.png", "adj3.dot", directory, false);  //GraphVizGenerator("adj4.txt", "adj4.png", "adj4.dot", directory, false);  //GraphVizGenerator("adj1.txt", "adj5.png", "adj5.dot", directory, true);  //GraphVizGenerator("adj2.txt", "adj6.png", "adj6.dot", directory, true);  //GraphVizGenerator("adj3.txt", "adj7.png", "adj7.dot", directory, true);  //GraphVizGenerator("adj4.txt", "adj8.png", "adj8.dot", directory, true);  GraphVizGenerator("adj24.txt", "adj17.png", "adj17.dot", directory, false);  }    /// <summary>  /// Generate a graph base on matrix of binary number (0 and 1)  /// </summary>  /// <param name="textFileName">matrix text file name provide by user</param>  /// <param name="imageFileName">image file name provide by user</param>  /// <param name="dotFileName">dot file name provide by user</param>  /// <param name="directory">location where to get text file, to save dot file and to save image file</param>  public static bool GraphVizGenerator(string textFileName, string imageFileName, string dotFileName, string directory, bool digraph)  {  //null check for all required inputs  if(textFileName != null || imageFileName != null || dotFileName != null || directory != null)  {  //check to make sure user don't provide empty string for any inputs  if(!textFileName.Equals(string.Empty) || !imageFileName.Equals(string.Empty) || !dotFileName.Equals(string.Empty) || !directory.Equals(string.Empty))  {  var lines = readTextFile(directory + textFileName);  var dotFileBody = generateDotFileBody(lines, digraph);  var dotFilePath = directory + dotFileName;  var dotFile = dotFileCompose(dotFileBody, dotFilePath);  generateImage(dotFile, imageFileName, directory);  if (File.Exists(directory + imageFileName))  {  return true;  }  else  {  return false;  }  }  else  {  return false;  }  }  else  {  return false;  }  }  /// <summary>  ///  /// </summary>  /// <param name="textFileName"></param>  /// <param name="imageFileName"></param>  /// <param name="dotFileName"></param>  /// <param name="directory"></param>  /// <returns></returns>  public bool GraphVizGeneratorV2(string textFileName, string imageFileName, string dotFileName, string directory, bool digraph)  {  return GraphVizGenerator(textFileName, imageFileName, dotFileName, directory, digraph);  }  /// <summary>  /// read text file  /// </summary>  /// <param name="path">file location</param>  /// <returns>lines of text files</returns>  private static string[] readTextFile(string path)  {  //check if the text file provided by user is  //existed in the foler  if (File.Exists(path))  {  if (path != null)  {  string[] lines;  lines = File.ReadAllLines(path);  File.Exists(path);  if (lines.Length > 0)  {  return lines;  }  else  {  return null;  }  }  else  {  return null;  }  }  else  {  return null;  }  }  /// <summary>  /// List of pre-populated Node name for a graph  /// assuming the maximum nodes for a graph is 24  /// </summary>  /// <returns>list of node names</returns>  private static char[] Letters()  {  char[] letters = { 'A', 'B', 'C', 'D', 'E', 'F', 'G', 'H', 'I', 'J', 'K', 'L', 'M', 'N', 'O', 'P', 'Q', 'R', 'S', 'T', 'U', 'V', 'W', 'X', 'Y', 'Z'};  return letters;  }  /// <summary>  /// Take array of string and generate a file body for a dot file  /// list of connect between nodes within a graph  /// </summary>  /// <param name="lines">list of lines between two nodes</param>  /// <returns>string body for a dot file</returns>  private static string generateDotFileBody(string[] lines, bool digraph)  {  if(lines != null && lines.Length > 0)  {  string graph = "graph matrix {";  string dgraph = "digraph matrix {";  string lastLine = "}";  string gconnector = "--";  string dgconnector = "->";  string connector = "";  //assign name for each node in the graph  var nodes = Letters();  string dotFileoBody;  if (digraph)  {  dotFileoBody = dgraph + "\n";  connector = dgconnector;  }  else  {  dotFileoBody = graph + "\n";  connector = gconnector;  }  //to keep track of all the nodes  List<string> completedNodes = new List<string>();  for (int i = 0; i < lines.Length; i++)  {  var list = lines[i].Trim().Replace(" ", string.Empty);  for (int j = 0; j < list.Length; j++)  {  if(j < list.Length && i < list.Length)  {  if (list[j].Equals('1'))  {  string part1 = nodes[i] + connector + nodes[j];  string part2 = nodes[j] + connector + nodes[i];  if (!completedNodes.Contains(part1) && !completedNodes.Contains(part2))  {  dotFileoBody = dotFileoBody + nodes[i] + connector + nodes[j] + "\n";  completedNodes.Add(part1);  completedNodes.Add(part2);  }  }  else if (list[j].Equals('0'))  {  string part1 = nodes[i].ToString();  string part2 = nodes[j].ToString();  if (!completedNodes.Contains(part1) && !completedNodes.Contains(part2))  {  dotFileoBody = dotFileoBody + nodes[j] + "\n";  completedNodes.Add(part1);  completedNodes.Add(part2);  }  }  }  }  }  dotFileoBody = dotFileoBody + lastLine;  return dotFileoBody;  }  else  {  return null;  }  }  /// <summary>  /// Build a dot file for graph  /// </summary>  /// <param name="stringbody">Dot file string body</param>  /// <param name="path">location and file name for the dot file</param>  private static string dotFileCompose(string stringbody, string path)  {  //delete the file if it already exsited in the foler  if (File.Exists(path))  {  File.Delete(path);  }  //write text into dot file  if(stringbody != null && !stringbody.Equals(string.Empty))  {  using (StreamWriter writer = File.CreateText(path))  {  writer.Write(stringbody);  writer.Flush();  writer.Dispose();  writer.Close();  }  File.Exists(path);  return path;  }  else  {  return null;  }  }    /// <summary>  /// Generate Graph based on dot file  /// </summary>  /// <param name="dotFile">dot file name</param>  /// <param name="imageFile">image file name</param>  /// <param name="directory"></param>  private static void generateImage(string dotFile, string imageFile, string directory)  {  //delete the image file if it already exsited in the foler  string exisitingImageFile = directory + imageFile;  if (File.Exists(exisitingImageFile))  {  File.Delete(exisitingImageFile);  }  //command to generage image file  string commandTemplate = "dot -Tpng {0} -o {1}";  //where to run the command  string application = "cmd.exe";  //complete command  string command = String.Format(commandTemplate, dotFile, imageFile);  using(Process process = new Process())  {  process.StartInfo = new ProcessStartInfo(application)  {  RedirectStandardInput = true,  UseShellExecute = false,  WorkingDirectory = directory  };  process.Start();  process.StandardInput.WriteLine(command);  process.StandardInput.Close();  process.WaitForExit();  process.CloseMainWindow();  process.Close();  }  }  }  } |

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| Test cases in codes (for better view, please refer to text file attachment) best application to view C# codes is NodePad++ - (file name: MainToolCodesInCSharp.txt) |
| using Microsoft.VisualStudio.TestTools.UnitTesting;  using cpsc5031\_hw6;  namespace GraphVizTestProject  {  [TestClass]  public class Main  {  //set initial directory for testing  //string directory = @"C:\Users\mr4eyesn\Desktop\CPSC5031\_2\week8\homework\code\cpsc5031\_hw6\files\";  string directory = @"C:\Users\dzzn\Desktop\CPSC5031\_02\week8\homework6\files\";  [TestMethod]  public void TestCase\_4by4Matrix\_1\_HappyPath\_Graph()  {  Program graph = new Program();  var check = graph.GraphVizGeneratorV2("adj1.txt", "adj1.png", "adj1.dot", directory, false);  Assert.AreEqual(true, check);  }  [TestMethod]  public void TestCase\_4by4Matrix\_2\_HappyPath\_Graph()  {  Program graph = new Program();  var check = graph.GraphVizGeneratorV2("adj2.txt", "adj2.png", "adj2.dot", directory, false);  Assert.AreEqual(true, check);  }  [TestMethod]  public void TestCase\_5by5Matrix\_1\_HappyPath\_Graph()  {  Program graph = new Program();  var check = graph.GraphVizGeneratorV2("adj3.txt", "adj3.png", "adj3.dot", directory, false);  Assert.AreEqual(true, check);  }  [TestMethod]  public void TestCase\_6by6Matrix\_1\_HappyPath\_Graph()  {  Program graph = new Program();  var check = graph.GraphVizGeneratorV2("adj4.txt", "adj4.png", "adj4.dot", directory, false);  Assert.AreEqual(true, check);  }  [TestMethod]  public void TestCase\_4by4Matrix\_1\_HappyPath\_Digraph()  {  Program graph = new Program();  var check = graph.GraphVizGeneratorV2("adj1.txt", "adj5.png", "adj5.dot", directory, true);  Assert.AreEqual(true, check);  }  [TestMethod]  public void TestCase\_4by4Matrix\_2\_HappyPath\_Digraph()  {  Program graph = new Program();  var check = graph.GraphVizGeneratorV2("adj2.txt", "adj6.png", "adj6.dot", directory, true);  Assert.AreEqual(true, check);  }  [TestMethod]  public void TestCase\_5by5Matrix\_1\_HappyPath\_Digraph()  {  Program graph = new Program();  var check = graph.GraphVizGeneratorV2("adj3.txt", "adj7.png", "adj7.dot", directory, true);  Assert.AreEqual(true, check);  }  [TestMethod]  public void TestCase\_6by6Matrix\_1\_HappyPath\_Digraph()  {  Program graph = new Program();  var check = graph.GraphVizGeneratorV2("adj4.txt", "adj8.png", "adj8.dot", directory, true);  Assert.AreEqual(true, check);  }  [TestMethod]  public void TestCase\_Check\_EmptyTextFile\_Graph()  {  Program graph = new Program();  var check = graph.GraphVizGeneratorV2("adj5.txt", "adj9.png", "adj9.dot", directory, false);  Assert.AreEqual(false, check);  }  [TestMethod]  public void TestCase\_Check\_EmptyTextFile\_digraph()  {  Program graph = new Program();  var check = graph.GraphVizGeneratorV2("adj5.txt", "adj10.png", "adj10.dot", directory, true);  Assert.AreEqual(false, check);  }  [TestMethod]  public void TestCase\_Check\_NoTextFileFoundInTheFolder\_Graph()  {  Program graph = new Program();  var check = graph.GraphVizGeneratorV2("adj20.txt", "adj9.png", "adj9.dot", directory, false);  Assert.AreEqual(false, check);  }  [TestMethod]  public void TestCase\_Check\_NoTextFileFoundInTheFolder\_dgraph()  {  Program graph = new Program();  var check = graph.GraphVizGeneratorV2("adj20.txt", "adj10.png", "adj10.dot", directory, true);  Assert.AreEqual(false, check);  }  [TestMethod]  public void TestCase\_Check\_TextFileHasSpecialCharactersMixWith\_0\_and\_1\_Graph()  {  Program graph = new Program();  var check = graph.GraphVizGeneratorV2("adj6.txt", "adj11.png", "adj11.dot", directory, false);  Assert.AreEqual(true, check);  }  [TestMethod]  public void TestCase\_Check\_TextFileHasSpecialCharactersMixWith\_0\_and\_1\_dgraph()  {  Program graph = new Program();  var check = graph.GraphVizGeneratorV2("adj6.txt", "adj12.png", "adj12.dot", directory, true);  Assert.AreEqual(true, check);  }  [TestMethod]  public void TestCase\_Check\_TextFileHasSpecialCharactersOnly\_Graph()  {  Program graph = new Program();  var check = graph.GraphVizGeneratorV2("adj7.txt", "adj12.png", "adj12.dot", directory, false);  Assert.AreEqual(true, check);  }  [TestMethod]  public void TestCase\_Check\_TextFileHasSpecialCharactersOnly\_Dgraph()  {  Program graph = new Program();  var check = graph.GraphVizGeneratorV2("adj7.txt", "adj13.png", "adj13.dot", directory, true);  Assert.AreEqual(true, check);  }  [TestMethod]  public void TestCase\_Check\_TextFileHas\_1\_Only\_Graph()  {  Program graph = new Program();  var check = graph.GraphVizGeneratorV2("adj8.txt", "adj13.png", "adj13.dot", directory, false);  Assert.AreEqual(true, check);  }  [TestMethod]  public void TestCase\_Check\_TextFileHas\_1\_Only\_dgraph()  {  Program graph = new Program();  var check = graph.GraphVizGeneratorV2("adj8.txt", "adj14.png", "adj14.dot", directory, true);  Assert.AreEqual(true, check);  }  [TestMethod]  public void TestCase\_Check\_TextFileHas\_0\_Only\_Graph()  {  Program graph = new Program();  var check = graph.GraphVizGeneratorV2("adj9.txt", "adj14.png", "adj14.dot", directory, false);  Assert.AreEqual(true, check);  }  [TestMethod]  public void TestCase\_Check\_TextFileHas\_0\_Only\_dgraph()  {  Program graph = new Program();  var check = graph.GraphVizGeneratorV2("adj9.txt", "adj15.png", "adj15.dot", directory, true);  Assert.AreEqual(true, check);  }  [TestMethod]  public void TestCase\_Check\_TextFileHas\_24\_nodes\_Graph()  {  Program graph = new Program();  var check = graph.GraphVizGeneratorV2("adj24.txt", "adj16.png", "adj16.dot", directory, false);  Assert.AreEqual(true, check);  }  [TestMethod]  public void TestCase\_Check\_TextFileHas\_24\_nodes\_dgraph()  {  Program graph = new Program();  var check = graph.GraphVizGeneratorV2("adj24.txt", "adj17.png", "adj17.dot", directory, true);  Assert.AreEqual(true, check);  }  [TestMethod]  public void TestCase\_Check\_TextFileHas\_25\_nodes\_Graph\_EdgeCase()  {  Program graph = new Program();  var check = graph.GraphVizGeneratorV2("adj25.txt", "adj18.png", "adj18.dot", directory, false);  Assert.AreEqual(true, check);  }  [TestMethod]  public void TestCase\_Check\_TextFileHas\_25\_nodes\_dgraph\_EdgeCase()  {  Program graph = new Program();  var check = graph.GraphVizGeneratorV2("adj25.txt", "adj19.png", "adj19.dot", directory, true);  Assert.AreEqual(true, check);  }  }  } |