CPSC 5031 - Homework 7

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Description
Being Greedy
Selected algorithm: Change-making problem – be able to input different kinds of coins

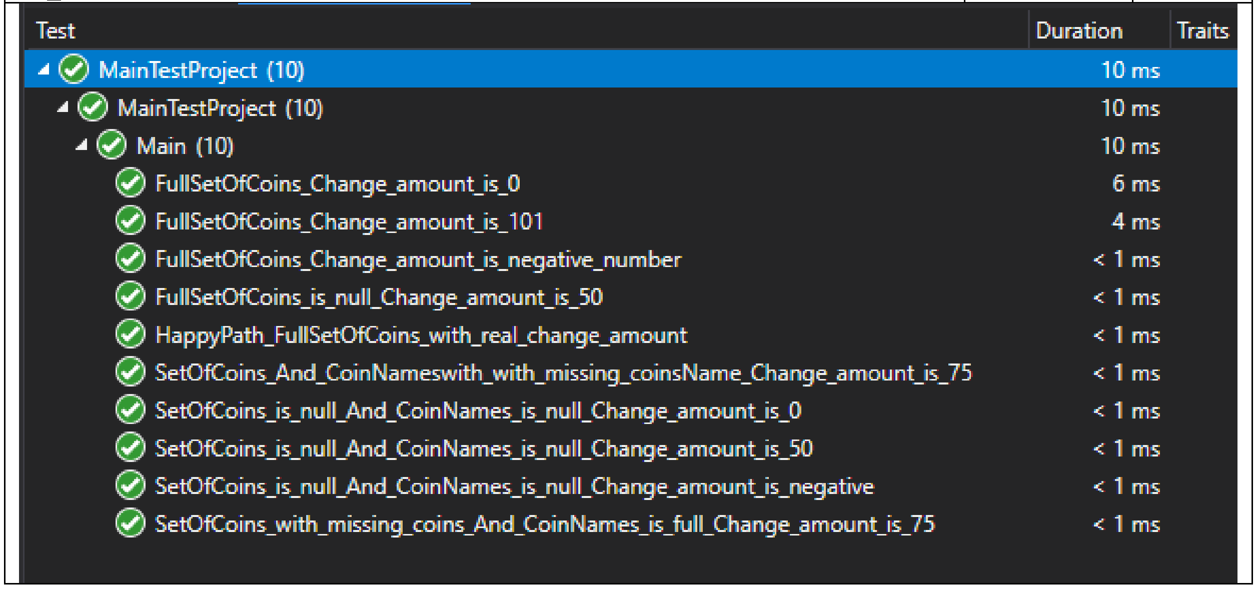
Summary after completed the homework
Even this is the simple algorithm to work. However, I think this couple a base tool that can be used and implemented into a cashier system. The system can simply build and help cashiers quickly get result of how many coins the buyer can get back a change. - Algorithm developed in C# - No add on support packages needed

Assumption to run this algorithm or tool
1. The algorithm can be run base on any currency (user has to modify the coin names and value of each coin before run it) 2. There is no limit number of changes amount (0 cent to more than 100 cents) 3. Tool only runs on Windows OS

Source code
https://github.com/davednguyen/cpsc5031_hw7.git
Branch
Develop
Main code project name: CPSCHomework7
Test codes project name: MainTestProject
Homework write-up location: https://github.com/davednguyen/cpsc5031_hw7/tree/develop/writeup
(easy view) main codes: https://github.com/davednguyen/cpsc5031_hw7/tree/develop/writeup
(easy view) test codes: https://github.com/davednguyen/cpsc5031_hw7/tree/develop/writeup

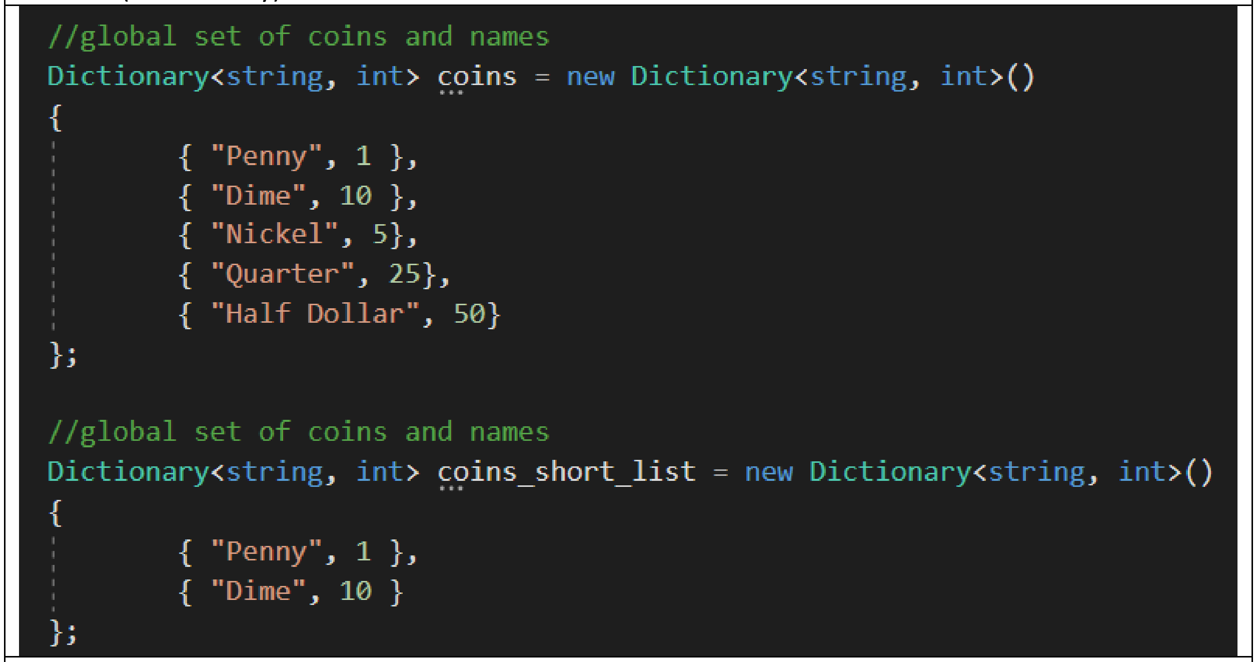
Total test cases: 10		
Test framework: MS Test		
Language: C#		
Test case name	Expected test result	Actual test result
`HappyPath_FullSetOfCoins_with_real_change_amount`	Pass	passed
`FullSetOfCoins_Change_amount_is_0`	Pass	passed

FullSetOfCoins_Change_amount_is_negative_number	Pass	passed
FullSetOfCoins_Change_amount_is_101	Pass	passed
FullSetOfCoins_is_null_Change_amount_is_50	Pass	passed
SetOfCoins_is_null_And_CoinNames_is_null_Change_amount_is_50	Pass	Passed
SetOfCoins_is_null_And_CoinNames_is_null_Change_amount_is_negative	Pass	Passed
SetOfCoins_is_null_And_CoinNames_is_null_Change_amount_is_0	Pass	Passed
SetOfCoins_with_missing_coins_And_CoinNames_is_full_Change_amount_is_75	Pass	Passed
SetOfCoins_And_CoinNameswith_with_missing_coinsName_Change_amount_is_75	Pass	Passed



```
Test                                                                          Duration   Traits
◢ ✓ MainTestProject (10)                                                        10 ms
  ◢ ✓ MainTestProject (10)                                                      10 ms
    ◢ ✓ Main (10)                                                               10 ms
        ✓ FullSetOfCoins_Change_amount_is_0                                      6 ms
        ✓ FullSetOfCoins_Change_amount_is_101                                    4 ms
        ✓ FullSetOfCoins_Change_amount_is_negative_number                      < 1 ms
        ✓ FullSetOfCoins_is_null_Change_amount_is_50                           < 1 ms
        ✓ HappyPath_FullSetOfCoins_with_real_change_amount                     < 1 ms
        ✓ SetOfCoins_And_CoinNameswith_with_missing_coinsName_Change_amount_is_75  < 1 ms
        ✓ SetOfCoins_is_null_And_CoinNames_is_null_Change_amount_is_0          < 1 ms
        ✓ SetOfCoins_is_null_And_CoinNames_is_null_Change_amount_is_50         < 1 ms
        ✓ SetOfCoins_is_null_And_CoinNames_is_null_Change_amount_is_negative   < 1 ms
        ✓ SetOfCoins_with_missing_coins_And_CoinNames_is_full_Change_amount_is_75  < 1 ms
```

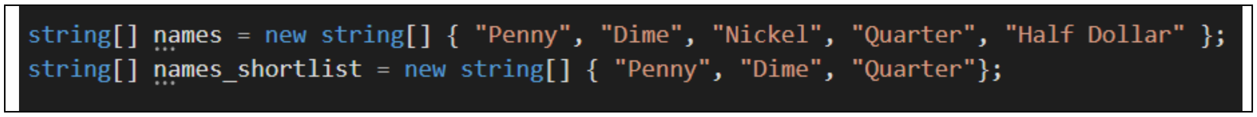
Coin list (US currency)



```
//global set of coins and names
Dictionary<string, int> coins = new Dictionary<string, int>()
{
        { "Penny", 1 },
        { "Dime", 10 },
        { "Nickel", 5},
        { "Quarter", 25},
        { "Half Dollar", 50}
};

//global set of coins and names
Dictionary<string, int> coins_short_list = new Dictionary<string, int>()
{
        { "Penny", 1 },
        { "Dime", 10 }
};
```

Coin names (US currency)



```
string[] names = new string[] { "Penny", "Dime", "Nickel", "Quarter", "Half Dollar" };
string[] names_shortlist = new string[] { "Penny", "Dime", "Quarter"};
```

Change-making algorithm codes

```
namespace CPSCHomework7
{
    public class Program
    {
        static void Main(string[] args)
        {
            var coins = new Dictionary<string, int>()
            {
                { "Penny", 1 },
                { "Dime", 10 },
                { "Nickel", 5},
                { "Quarter", 25},
                { "Half Dollar", 50}
            };

            Dictionary<string, int> coins_short_list = new Dictionary<string, int>()
        {
                { "Penny", 1 },
                { "Dime", 10 }
        };

            var names = new string[] { "Penny", "Dime", "Nickel", "Quarter", "Half
Dollar"};

            //for(int i = 0; i < 100; i++)
            //{
            //    Console.WriteLine(CalculateChange(coins, names, i));
            //}
            //Console.WriteLine(CalculateChange(null, names, 50));

            Console.WriteLine(CalculateChange(coins_short_list, names, 50));
        }

        /// <summary>
        /// Main function to calculate changes based on coin
        /// </summary>
        /// <param name="coins">list of coins</param>
        /// <param name="names">list of coin names</param>
        /// <param name="change">required changes</param>
        /// <returns></returns>
        public static string CalculateChange(Dictionary<string, int> coins,
string[]names, int change)
        {
            var calculateChange  = GetChanges(coins, change);
            var total = TotalCoins(calculateChange, names);
            var display = DisplayCoins(calculateChange, names, change);
            return "Total coin: "+ total +" " + display;
        }
        /// <summary>
        /// Main function to calculate changes based on coin - for testing purposes
        /// </summary>
        /// <param name="coins">list of coins</param>
        /// <param name="names">list of coin names</param>
        /// <param name="change">required changes</param>
        /// <returns></returns>
        public string CalculateChanges(Dictionary<string, int> coins, string[] names,
int change)
        {
            return CalculateChange(coins, names, change);
        }

        /// <summary>
        /// function to provide list of coins and change needed
        /// </summary>
        /// <param name="coins">list of available coins</param>
        /// <param name="change">required change</param>
        /// <returns></returns>
        public static Dictionary<string, int> GetChanges(Dictionary<string, int> coins,
int change)
        {
            if (change != 0 && coins != null && coins.Count > 0)
            {
                //save possilbe change calculation
                var possibleChangeResults = new Dictionary<string, int>();
                //order the coin values decending values
                coins.OrderByDescending((value) => value.Value);
                //search through list of coins find possible changes amount
                foreach (var coin in coins.OrderByDescending((value) => value.Value))
                {
                    //update total coin needed for a change
                    int totalCoin = 0;
                    while (change >= coin.Value)
                    {
                        change = change - coin.Value;
                        totalCoin++;
                    }
                    possibleChangeResults.Add(coin.Key, totalCoin);
                }
                return possibleChangeResults;
            }
            else
            {
                return null;
            }
        }

        /// <summary>
        /// list for total coins needed for a change
        /// </summary>
        /// <param name="coins">list of coins</param>
        /// <param name="coinName"> list of coin names</param>
        /// <returns>total number of coins based on each type</returns>
        public static int TotalCoins(Dictionary<string, int> coins, string[] coinName)
        {
            if(coins != null && coinName != null)
            {
                int total = 0;
                for (int i = 0; i < coinName.Length; i++)
                {
                    string name = coinName[i];
                    if (coins.ContainsKey(name))
                    {
                        total = total + coins[name];
                    }
                }
                return total;
            }
            else
            {
                return 0;
            }
        }

        /// <summary>
        /// Display how many coins need of each type.
        /// </summary>
        /// <param name="coins"> list of coins needed</param>
        /// <param name="coinName"> list of coin names</param>
        /// <param name="change">change amount required</param>
        /// <returns>String - display each coin type needed</returns>
        public static string DisplayCoins(Dictionary<string, int> coins, string[]
coinName, int change)
        {
            if(coins != null && coins.Count > 0 && change > 0 && coinName != null)
            {
                string totalCoin = "Change amount: " + change;
                for (int i = 0; i < coinName.Length; i++)
                {
                    string name = coinName[i];
                    if (coins.ContainsKey(name))
                    {
                        totalCoin = totalCoin + " coin name: " + name + ":" +
coins[name];
                    }
                }
                return totalCoin;
            }
            else
            {
                return null;
            }
        }
    }
}
```

Test codes

```
using Microsoft.VisualStudio.TestTools.UnitTesting;
using CPSCHomework7;
using System.Collections.Generic;

namespace MainTestProject
{
    [TestClass]
    public class Main
    {
        //global set of coins and names
        Dictionary<string, int> coins = new Dictionary<string, int>()
        {
                { "Penny", 1 },
                { "Dime", 10 },
                { "Nickel", 5},
                { "Quarter", 25},
                { "Half Dollar", 50}
        };

        //global set of coins and names
        Dictionary<string, int> coins_short_list = new Dictionary<string, int>()
        {
                { "Penny", 1 },
                { "Dime", 10 }
        };

        string[] names = new string[] { "Penny", "Dime", "Nickel", "Quarter", "Half
Dollar" };
        string[] names_shortlist = new string[] { "Penny", "Dime", "Quarter"};

        [TestMethod]
        public void HappyPath_FullSetOfCoins_with_real_change_amount()
        {
            string expected = "Total coin: 8 Change amount: 99 coin name: Penny:4 coin
name: Dime:2 coin name: Nickel:0 coin name: Quarter:1 coin name: Half Dollar:1";
            Program program = new Program();
            string test = program.CalculateChanges(coins, names, 99);
            Assert.AreEqual(expected, test);
        }

        [TestMethod]
        public void FullSetOfCoins_Change_amount_is_0()
        {
            string expected = "Total coin: 0 ";
            Program program = new Program();
            string test = program.CalculateChanges(coins, names, 0);
            Assert.AreEqual(expected, test);
        }

        [TestMethod]
        public void FullSetOfCoins_Change_amount_is_negative_number()
        {
            string expected = "Total coin: 0 ";
            Program program = new Program();
            string test = program.CalculateChanges(coins, names, -1);
            Assert.AreEqual(expected, test);
        }

        [TestMethod]
        public void FullSetOfCoins_Change_amount_is_101()
        {
            string expected = "Total coin: 3 Change amount: 101 coin name: Penny:1 coin
name: Dime:0 coin name: Nickel:0 coin name: Quarter:0 coin name: Half Dollar:2";
            Program program = new Program();
            string test = program.CalculateChanges(coins, names, 101);
            Assert.AreEqual(expected, test);
        }

        [TestMethod]
        public void FullSetOfCoins_is_null_Change_amount_is_50()
        {
            string expected = "Total coin: 0 ";
            Program program = new Program();
            string test = program.CalculateChanges(null, names, 50);
            Assert.AreEqual(expected, test);
        }

        [TestMethod]
        public void SetOfCoins_is_null_And_CoinNames_is_null_Change_amount_is_50()
        {
            string expected = "Total coin: 0 ";
            Program program = new Program();
            string test = program.CalculateChanges(null, null, 50);
            Assert.AreEqual(expected, test);
        }

        [TestMethod]
        public void
SetOfCoins_is_null_And_CoinNames_is_null_Change_amount_is_negative()
        {
            string expected = "Total coin: 0 ";
            Program program = new Program();
            string test = program.CalculateChanges(null, null, -1);
            Assert.AreEqual(expected, test);
        }

        [TestMethod]
        public void SetOfCoins_is_null_And_CoinNames_is_null_Change_amount_is_0()
        {
            string expected = "Total coin: 0 ";
            Program program = new Program();
            string test = program.CalculateChanges(null, null, 0);
            Assert.AreEqual(expected, test);
        }

        [TestMethod]
        public void
SetOfCoins_with_missing_coins_And_CoinNames_is_full_Change_amount_is_75()
        {
            string expected = "Total coin: 12 Change amount: 75 coin name: Penny:5 coin
name: Dime:7";
            Program program = new Program();
            string test = program.CalculateChanges(coins_short_list, names, 75);
            Assert.AreEqual(expected, test);
        }

        [TestMethod]
        public void
SetOfCoins_And_CoinNameswith_with_missing_coinsName_Change_amount_is_75()
        {
            string expected = "Total coin: 1 Change amount: 75 coin name: Penny:0 coin
name: Dime:0 coin name: Quarter:1";
```

```
            Program program = new Program();
            string test = program.CalculateChanges(coins, names_shortlist, 75);
            Assert.AreEqual(expected, test);
        }
    }
}
```