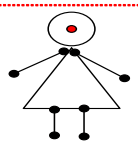
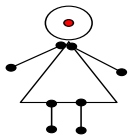
Question 61: How do I think more like a programmer?
Answer 61: Imagine you have a class of students. Each student has his or her own grades. Find the average grade of each student.

| Mary | Louisa |
|---|---|
| Grades | Grades |
| 98 | 99 |
| 89 | 91 |
| 85 | 86 |

1. Draw a picture, and label it clearly. Many times, the picture can be a simplified version of the real situation.

2. Try an approach to the code based on simplicity and directness. For example, turn Mary's grades into an array, add the grades, divide by the total number of grades and print as the average.

```
using static System.Console;
class Program
{
    static void Main()
    {
        int[] maryGrades = { 98, 89, 85 };
        var marySum = maryGrades[0] + maryGrades[1] + maryGrades[2];
        var maryAverage = marySum / maryGrades.Length;
        WriteLine($"Mary's average={maryAverage}");

        int[] louisaGrades = { 99, 91, 86};
        var louisaSum = louisaGrades[0] + louisaGrades[1] + louisaGrades[2];
        var louisaAverage = louisaSum / louisaGrades.Length;
        WriteLine($"Louisa's average={louisaAverage}");
    }
}
```

```
Mary's average=90
Louisa's average=92
```

3. If you have many grades for each student, finding the sum by adding entries together is not practical. It's easier to form a sum with a foreach loop, so adjust the code. You're extending the simple example to a more realistic case.

```
using static System.Console;
class Program
{
    static void Main()
    {
        int[] maryGrades = { 98, 89, 85 };
        var marySum = 0;
        foreach (var grade in maryGrades)
            marySum += grade;
        var maryAverage = marySum / maryGrades.Length;
        WriteLine($"Mary's average={maryAverage}");

        int[] louisaGrades = { 99, 91, 86};
        var louisaSum = 0;
        foreach (var grade in louisaGrades)
            louisaSum += grade;
        var louisaAverage = louisaSum / louisaGrades.Length;
        WriteLine($"Louisa's average={louisaAverage}");
    }
}
```

4. If there are many students, it's not practical to go through the process of finding each average, for each student, manually. But we see that a class is really an array of arrays, so form an array of arrays to hold all the grades. Now if there are many students, the code runs as is, and if there are many grades, the code also runs as is.

```
using static System.Console;
class Program
{
    static void Main()
    {
        int[][] studentGrades = {new int[]{ 98, 89, 85 },
                                 new int[] {99,91,86 } };
        int sum = 0;                                          //1. Keeps track of sum
        foreach(var student in studentGrades)                 //2. Grabs each array of grades
        {
            foreach(var grade in student)                     //3. Grabs grades, one by one
            {                                                 //   from each array
                sum += grade;                                 //4. Adds grades
            }
            WriteLine($"Average={sum / student.Length}"); //5. Prints average
            sum = 0;                                          //6. Clears sum after each student
        }
    }
}
```