# Topic 4

1. Arrays
2. Common array algorithms
3. Arrays / functions
4. Problem solving: adapting algorithms
5. Problem solving: discovering algorithms
6. 2D arrays
7. Vectors
8. Chapter Summary

# Problem Solving: Adapting Algorithms

Recall that you saw quite a few
(too many?)
algorithms for working with arrays.

Suppose you need to solve a problem that does not exactly fit any of those?

What to do?

No, “give up” is not an option!

***You can adapt algorithms you already know to produce a new algorithm.***

# Problem Example: Summing Quiz Scores

Consider this problem:

Compute the final quiz score from a set of quiz scores,

but be nice:

drop the lowest score.

# Adapting Algorithms: Three that We Know

Calculate the sum:

```
double total = 0;
for (int i = 0; i < size of values; i++)
{
   total = total + values[i];
}
```

Find the minimum:

```
double smallest = values[0];
for (int i = 1; i < size of values; i++)
{
   if (values[i] < smallest)
   {
      smallest = values[i];
   }
}
```

Remove an element:

```
values[pos] = values[current_size - 1];
current_size--;
```

# Adapting Algorithms: A Glitch in Combining Those Three

```
values[pos] = values[current_size - 1];
current_size--;
```

This algorithm removes by knowing *the position* of the element to remove… …but…

```
double smallest = values[0];
 for (int i = 1; i < size of values; i++)
 {
     if (values[i] < smallest)
     {
         smallest = values[i];
     }
 }
```

That's not the *position* of the smallest – it IS the smallest.

# Algorithm to Find the Position

Here's another algorithm I know that *does* find the position:

```
int pos = 0;
bool found = false;
while (pos < size of values && !found)
{
    if (values[pos] == 100) // looking for 100
    {
        found = true;
    }
    else
    {
        pos++;
    }
}
```

# Adapting the Minimum Algorithm to Report the Position

Combining the minimum value algorithm with the position-finder:

```
int smallest_position = 0;
for (int i = 1; i < size of values; i++)
{
    if (values[i] < values[smallest_position])
    {
        smallest_position = i;
    }
}
```

# Final Answer for Adapting Algorithms

Aha! Here is the algorithm:

1. *Find the **position** of the minimum*
2. *Remove it from the array*
3. *Calculate the sum*
*(will be without the lowest score)*
4. *Calculate the final score*

# Topic 5

1. Arrays
2. Common array algorithms
3. Arrays / functions
4. Problem solving: adapting algorithms
5. <u>Problem solving: discovering algorithms</u>
6. 2D arrays
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8. Chapter Summary

# Discovering Algorithms by Manipulating Physical Objects

What if you come across a problem
for which you cannot find an algorithm you know
and you cannot figure out how to adapt any algorithms?

you can use a technique called:

MANIPULATING PHYSICAL OBJECTS

better know as:

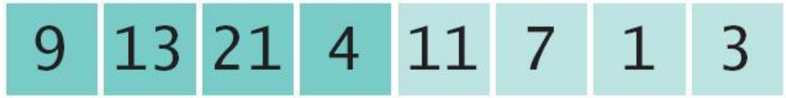
*playing around with things*.

# Manipulating Physical Objects: Example Problem

Here is a problem:

You are given an array whose size is an even number.
You are to switch the first and the second half.

Before:




After:

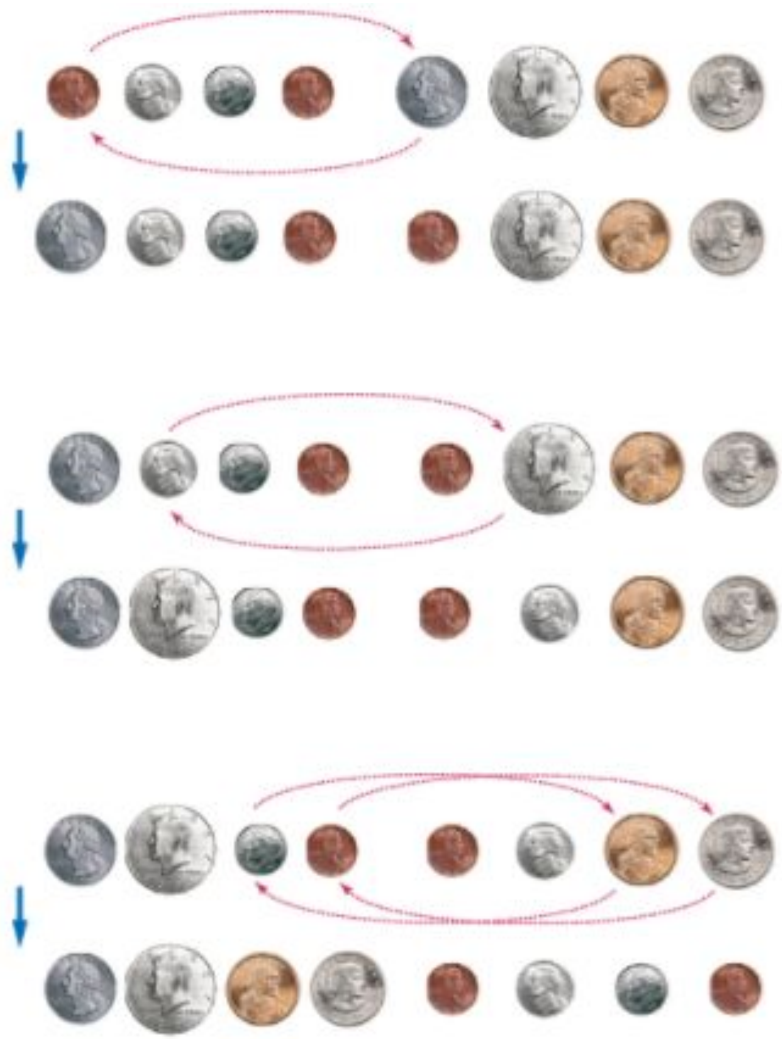
# Manipulating Physical Objects: Coins

We'll use 8 coins as a model for our 8-elements of the array

We can swap coins like we'd swap array elements:

# Swapping Coins: the Algorithm

- We find that by swapping the
  - $0^{st}$ and $4^{th}$ coins, and
  - $1^{nd}$ and $5^{th}$
  - $2^{rd}$ and $6^{th}$
  - And $3^{rd}$ and $7^{th}$
  - We have swapped the first half of the 8 with the last



# Translating the Manipulations to Code

Pseudocode:

```
i = 0
j = size / 2
While i < size / 2
   Swap elements at positions i and j.
   i++
   j++
```

Translating to C++ is left as a Programming Exercise at the end of the chapter

# Self Check: Practice Manipulating Objects

Using physical objects such as coins to represent array elements, determine the purpose of the function below:

```
void transform(int array[], int length)
{
    int position = 0;
    for (int k = 1; k < length; k++)
    {
        if (array[k] < array[position])
        {
            position = k;
        }
    }
    int temp = array[position];
    while (position > 0)
    {
        array[position] = array[position - 1];
        position--;
    }
    array[0] = temp;
}
//ANSWER: copies the smallest value to the first array
location and shifts other elements so no values are lost
```