L6. More on Iteration

Using a Count Variable

Developing For-Loop Solutions

A Year-Printing Fragment

```
First = input('Enter first year');
Last = input('Enter last year');
for y = First:Last
   fprintf('%5d\n',y)
end
```

How It Works

```
for y = First:Last
   fprintf('%5d\n',y))
end
```

1999	2001	
First	Last	y

Suppose First is 1999 and Last is 2001.

How It Works

```
for y = First:Last
   fprintf('%5d\n',y)
end
```

1999	2001	1999
First	Last	y

We enter the for-loop and y is initialized

How It Works

```
for y = First:Last
   fprintf('%5d\n',y))
end
```

1999	2001	1999
First	Last	y

Is the value in y <= than the value in Last?

How It Works

```
for y = First:Last
   fprintf('%5d\n',y)
end
```

Output

1999

1999	2001	2000
First	Last	y

Yes. Execute the loop body and increment y.

How It Works

```
for y = First:Last
   fprintf('%5d\n',y)
end
```

Output

1999

1999	2001	2000
First	Last	y

Is the value in y <= the value in Last?

How It Works

```
for y = First:Last
   fprintf('%5d\n',y)
end
```

Output

1999

2000

1999	2001	2001
First	Last	y

Yes. Execute the loop body and increment y.

How It Works

```
for y = First:Last
   fprintf('%5d\n',y)
end
```

Output

1999

2000

1999	2001	2001
First	Last	y

Is the value in y <= the value in Last?

How It Works

```
for y = First:Last
   fprintf('%5d\n',y)
end
```

Output

1999

2000

2001

1999	2001	2002
First	Last	y

Yes. Execute the loop body and increment y.

How It Works

```
for y = First:Last
   fprintf('%5d\n',y)
end
```

Output

1999

2000

2001

1999	2001	2002
First	Last	y

Is the value in y <= the value in Last?

How It Works

```
for y = First:Last
   fprintf('%5d\n',y)
end
```

Output

1999

2000

2001

1999	2001	2002
First	Last	y

No. The loop is finished.

Problem Solving With the For-Loop

```
for count variable = expression for starting value : expression for ending value
    The calculation
    to be repeated.
end
```

Developing For-Loop Solutions

Illustrate the thinking associated with the design of for-loops

The methodology of stepwise refinement.

An example..

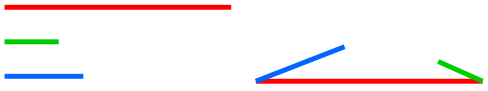
A Game: TriStick

Pick three sticks each having a random length between zero and one.

You win if you can form a triangle whose sides are the sticks. Otherwise you lose.

Win:

Lose:



Problem

Estimate the probability of winning a game of TriStick by simulating a million games and counting the number of wins.

Pseudocode

```
Initialize running sum variable.
Repeat 1,000,000 times:
    Play a game of TriStick by picking
        the three sticks.
    If you win
        increment the running sum
Estimate the probability of winning
```

Refine…

```
% Initialize running sum variable.
wins = 0;
for n = 1:1000000
    Play the nth game of TriStick by
        picking the three sticks.
    If you win
        increment the running sum.
end
% Estimate the prob of winning
p = wins/1000000
```

Refine the Loop Body

Play the nth game of TriStick by
picking the three sticks.
If you win
increment the running sum.

Refine the Loop Body

```
% Play the nth game of TriStick
% by picking the three sticks.
a=rand(1); b=rand(1); c=rand(1);

if (a<b+c) && (b<a+c) && (c<a+b)
    % No stick is longer than the
    % sum of the other two.
    wins = wins+1;
end
```

Key Problem-Solving Strategy

Progress from pseudocode to Matlab through a sequence of refinements.

Comments have an essential role during the transitions. They "stay on" all the way to the finished fragment.