Loops: Let's do this 1,000 more times...

Shiffman Chpt. 6

Why are computers so powerful? **Two Views**

- They do incredibly complicated things
 - > Some of the time. Some programs are very sophisticated.
- They do simple things, over and over again, very, very quickly
 - > Much of the time
 - > The output can look like intelligent behavior, when it is really brute force

Need for Repetition

- Copying doesn't scale
 - > 5, OK,
 - > 10, OK
 - > 100, maybe?
 - ▶ 1,000,000 !?!?!?!
- May want to vary behavior for each "item" processed
 - > e.g. drawing a lot of rectangles, but changing their position
- Much of the power of computers comes from being able to do the same, simple thing many, many times, very, very quickly

Very fast?

- Most computer processors run in the gigahertz range (e.g. 2.3 GHz)
- giga means billion

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- Hertz is times per second
- e.g.: 2, 300, 000, 000 instructions per second (more or less)
 - > Actual instructions may take more than one clock tick

Basic Structure of a Loop

<Condition to check>

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//Block of code you keep running //as long as condition is true

}

for Loop Good for counting (e.g. if you know how many times you want loop to run) Syntax: for(<initialize variable>; <condition check>; <update variable>) //code to get executed



This is a common form. Will run 10 times.

Nested Loops: Loops within Loops for(int i = 0; i<29; i = i+1) { for(int j = 0; j<28; j = j+1) { //draw all rects rect(10+ 20*i, 20 + j*20, 10, 10); } }

while Loop

- Good if you want to evaluate a condition to stop
- Don't need to know how many times you want to loop
 - > Just need a condition that will tell you when you're done

while Example

float edgeLength = 550; //condition specifies when pattern is done while(edgeLength > 1) { //draw all rects rect(300, 300, edgeLength, edgeLength); //decrease edgeLength //MUST UPDATE CONDITION IN LOOP edgeLength = edgeLength * .9; }

Infinite Loop!

• Condition *must* fail at some point, or loop will run for ever

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> Infinite loop! Program never endsFor example:
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for(int i =1; i > 0; i = i +1) {}
  While example:
  int a = 3;
  while(a < 20) {
    rect(10, 15, a, a);
  }
</pre>
```

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}
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Examples

- Use conditions in loop to modify behavior
- Use another variable to modify behavior
- Change color based on index
- Combine loop with animation index

