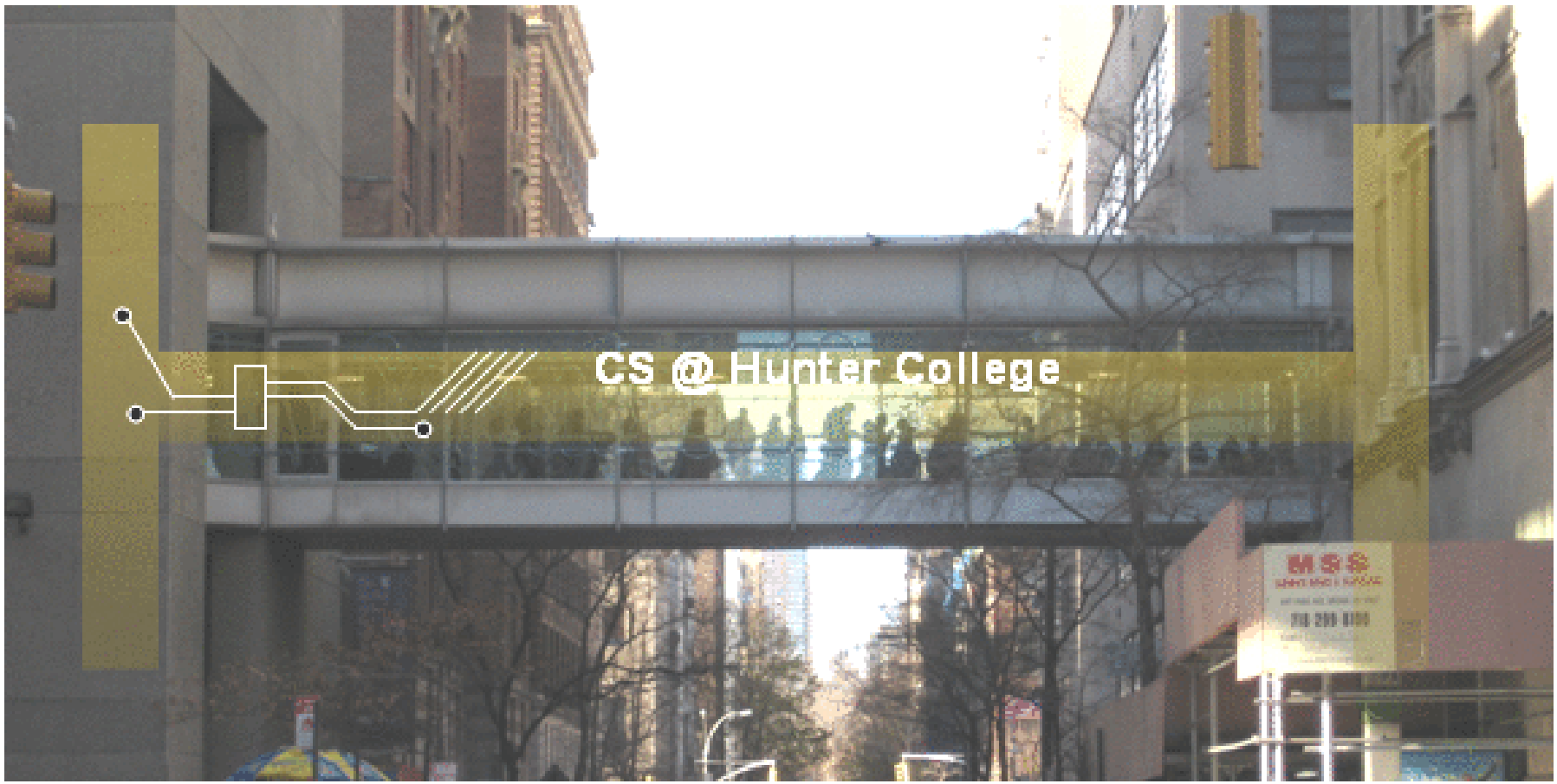
CSci 127: Introduction to Computer Science

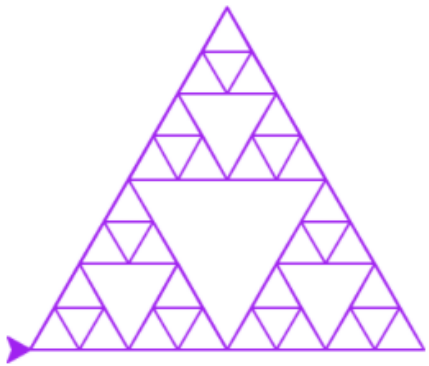


hunter.cuny.edu/csci

Lecture Slips: tinyurl.com/yc2b6jba

In Python, if your main() function and the program output look like this, which function definition should you have for triangle()?

```
def main():
    tess = turtle.Turtle()
    tess.color("purple")
    triangle(tess, 160)
```



```
def triangle(t, side):
    if side > 10:
        for i in range(3):
            t.forward(side)
            t.left(120)
        triangle(t, side/2)
```

○ a)

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def triangle(t, side):
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        for i in range(3):
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```
def triangle(t, side):
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def triangle(t, side):
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```

○ d)

Announcements

- Each lecture includes a survey of computing research and tech in NYC.

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- Today's lecturers include:
  - Prof. Sakas (department chair),
  - Genady Maryash (adjunct coordinator),
  - Katherine Howitt (tutor coordinator).

Today's Topics

- Recap: I/O & Definite Loops in C++
- Conditionals in C++
- Indefinite Loops in C++
- Functions in C++

CS Surveys

- Each lecture includes a survey of computing research and tech in NYC.

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In Pairs or Triples:

Predict what the following pieces of code will do:

```cpp
//Demonstrates conditionals
#include <iostream>
using namespace std;

int main ()
{
    int yearBorn;
    cout << "Enter year born: ";
    cin >> yearBorn;
    if (yearBorn < 1946)
    {
        cout << "Greatest Generation";
    }
    else if (yearBorn <= 1964)
    {
        cout << "Baby Boomer";
    }
    else if (yearBorn <= 1984)
    {
        cout << "Generation X";
    }
    else if (yearBorn <= 2004)
    {
        cout << "Millennial";
    }
    else
    {
        cout << "TBD";
    }

    return 0;
}
```

```cpp
using namespace std;

int main ()
{
    string conditions = "blowing snow";
    int winds = 100;
    float visibility = 0.2;

    if ( ( (winds > 35) && (visibility < 0.25) ) &&
         ( (conditions == "blowing snow") ||
           (conditions == "heavy snow") ) )
        cout << "Blizzard!\n";

    string origin = "South Pacific";

    if (winds > 74)
        cout << "Major storm, called a ";
    if ((origin == "Indian Ocean")
        ||(origin == "South Pacific"))
        cout << "cyclone.\n";
    else if (origin == "North Pacific")
        cout << "typhoon.\n";
    else
        cout << "hurricane.\n";
```

Introduction to C++

```cpp
//Another C++ program, demonstrating I/O & arithmetic
#include <iostream>
using namespace std;

int main ()
{
  float kg, lbs;
  cout << "Enter kg: ";
  cin >> kg;
  lbs = kg * 2.2;
  cout << endl << "Lbs: " << lbs << "\n\n";
  return 0;
}
```

Introduction to C++

- Efficient for systems programming.

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- To get input: `cin >> num;`
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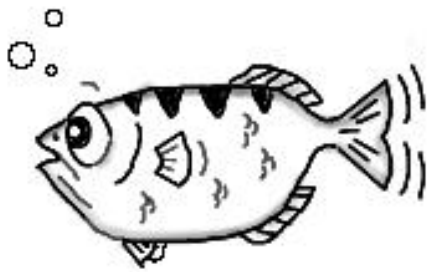
  `#include <iostream>`
  `using namespace std;`
- Definite loops:
  `for (i = 0; i < 10; i++) {...}`
- Blocks of code uses '{' and '}'.
- Commands generally end in ';'.

Side Note: gdb



gdb.org

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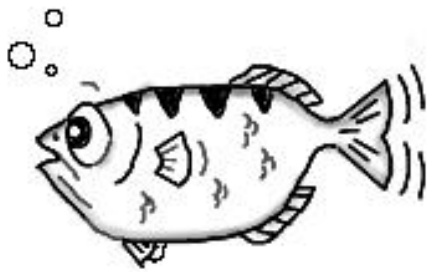

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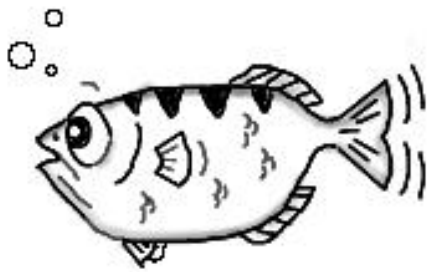

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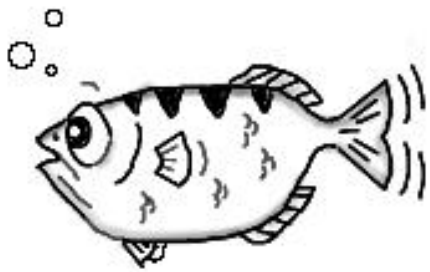

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- Written in 1986, gdb is the GNU debugger and based on dbx from the Berkeley Distribution of Unix.
- Lightweight, widely-available program that allows you to "step through" your code line-by-line.
- Available on the lab machines (via command-line and the IDE spyder) and on-line (onlinegdb.com).

C++ Demo

```cpp
//Demonstrates conditionals
#include <iostream>
using namespace std;

int main ()
{
    int yearBorn;
    cout << "Enter year born: ";
    cin >> yearBorn;
    if (yearBorn < 1946)
    {
        cout << "Greatest Generation";
    }
    else if (yearBorn <= 1964)
    {
        cout << "Baby Boomer";
    }
    else if (yearBorn <= 1984)
    {
        cout << "Generation X";
    }
    else if (yearBorn <= 2004)
    {
        cout << "Millennial";
    }
    else
    {
        cout << "TBD";
    }

    return 0;
}
```

(Demo with `onlinegdb`)

Conditionals

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//Demonstrates conditionals
#include <iostream>
using namespace std;

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    }
    else if (yearBorn <= 2004)
    {
        cout << "Millennial";
    }
    else
    {
        cout << "TBD";
    }

    return 0;
}
```

General format:

```
if ( logical expression )
{
      command1;
      ...
}
else if ( logical expression )
{
      command1;
      ...
}
else
{
      command1;
      ...
}
```

Logical Operators in C++

Very similar, just different names: `&&`, `||`, and `!`:

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and (`&&`)

in1		in2	*returns:*
`False`	`&&`	`False`	`False`
`False`	`&&`	`True`	`False`
`True`	`&&`	`False`	`False`
`True`	`&&`	`True`	`True`

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`True`	`&&`	`False`	`False`
`True`	`&&`	`True`	`True`

or (`||`)

in1		in2	*returns:*
`False`	`||`	`False`	`False`
`False`	`||`	`True`	`True`
`True`	`||`	`False`	`True`
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`False`	`||`	`True`	`True`
`True`	`||`	`False`	`True`
`True`	`||`	`True`	`True`

not (`!`)

	in1	*returns:*
`!`	`False`	`True`
`!`	`True`	`False`

In Pairs or Triples:

Predict what the following pieces of code will do:

```cpp
//Demonstrates loops
#include <iostream>
using namespace std;

int main ()
{
  int num;
  cout << "Enter an even number: ";
  cin >> num;
  while (num % 2 != 0)
  {
      cout << "\nThat's odd!\n";
      cout << "Enter an even number: ";
      cin >> num;
  }
  cout << "You entered: "
       << num << ".\n";
  return 0;
}
```

```cpp
//Demonstrates do-while loops
#include <iostream>
using namespace std;

int main ()
{
  int num;
  do
  {
      cout << "Enter an even number: ";
      cin >> num;
  } while (num % 2 != 0);

  cout << "You entered: "
       << num << ".\n";
  return 0;
}
```

```cpp
//While Growth example
#include <iostream>
using namespace std;

int main ()
{
  int population = 100;
  int year = 0;
  cout << "Year\tPopulation\n";
  while (population < 1000)
  {
      cout << year << "\t" << population << "\n";
      population = population * 2;
  }
  return 0;
}
```

C++ Demo

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//Demonstrates loops
#include <iostream>
using namespace std;

int main ()
{
  int num;
  cout << "Enter an even number: ";
  cin >> num;
  while (num % 2 != 0)
  {
      cout << "\nThat's odd!\n";
      cout << "Enter an even number: ";
      cin >> num;
  }
  cout << "You entered: "
       << num << ".\n";
  return 0;
}
```

(Demo with onlinegdb)

Indefinite Loops: `while`

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//Demonstrates loops
#include <iostream>
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  int num;
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      cout << "Enter an even number: ";
      cin >> num;
  }
  cout << "You entered: "
       << num << ".\n";
  return 0;
}
```

General format:

`while` (*logical expression*)
{

command1;
command2;
command3;
...

}

Indefinite Loops: `do-while`

```cpp
//Another C++ program; Demonstrates loops
#include <iostream>
using namespace std;

int main ()
{
  int i,j,size;
  cout << "Enter size: ";
  cin >> size;
  for (i = 0; i < size; i++)
  {
    for (j = 0; j < size; j++)
      cout << "*";
    cout << endl;
  }
  cout << "\n\n";
  for (i = size; i > 0; i--)
  {
    for (j = 0; j < i; j++)
      cout << "*";
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  }
  return 0;
}
```

General format:

```
do
{
        command1;
        command2;
        command3;
        ...
}
while ( logical expression )
```

Final Review Questions

```
#Name:  your name here
#Date:  October 2017
#This program, uses functions,
#     says hello to the world!

def main():
     print("Hello, World!")

if __name__ == "__main__":
     main()
```

Plan: Alternate between working in pairs and sketching solutions (until time runs out):

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- Definite Loops in Python & C++

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      cout << "*";
    cout << endl;
  }
  return 0;
}
```

Plan: Alternate between working in pairs and sketching solutions (until time runs out):

- Definite Loops in Python & C++
- Conditionals in Python & C++

Final Review Questions

```python
#Name:  your name here
#Date:  October 2017
#This program, uses functions,
#     says hello to the world!

def main():
     print("Hello, World!")

if __name__ == "__main__":
     main()
```

```cpp
//Another C++ program; Demonstrates loops
#include <iostream>
using namespace std;

int main ()
{
  int i,j,size;
  cout << "Enter size: ";
  cin >> size;
  for (i = 0; i < size; i++)
  {
    for (j = 0; j < size; j++)
      cout << "*";
    cout << endl;
  }
  cout << "\n\n";
  for (i = size; i > 0; i--)
  {
    for (j = 0; j < i; j++)
      cout << "*";
    cout << endl;
  }
  return 0;
}
```

Plan: Alternate between working in pairs and sketching solutions (until time runs out):

- Definite Loops in Python & C++
- Conditionals in Python & C++
- Indefinite Loops in Python & C++

In Pairs or Triples: Definite Loops in Python & C++

Complete as many as possible:

- *Python: what is the output?*

```
for i in range(2017, -2, 2000):
    print("Year is", i)
```

- *C++: what is the output?*

```
int i;
for (i = 2017; i > 2000; i = i - 2)
    cout << "Year is " << i << endl)
```

- In Python, write a complete program that prints out 1 to 100.
- In C++, write a complete program that prints out 1 to 100.

In Pairs or Triples: Definite Loops in Python & C++

- *Python: what is the output?*

```
for i in range(2017, -2, 2000):
    print("Year is", i)
```

In Pairs or Triples: Definite Loops in Python & C++

- *C++: what is the output?*

```
int i;
for (i = 2017; i > 2000; i = i - 2)
    cout << "Year is " << i << endl)
```

In Pairs or Triples: Definite Loops in Python & C++

- In Python, write a complete program that prints out 1 to 100.

In Pairs or Triples: Definite Loops in Python & C++

- In C++, write a complete program that prints out 1 to 100.

In Pairs or Triples: Conditionals in Python & C++

- *Python: what is the output?*

```
year = 2016
if year % 4 == 0 and \
    (not (year % 100 == 0) or (year % 400 == 0)):
     print("Leap!!")
```

- *C++: what is the output?*

```
int i = 13;
if ((i % 2 == 1) && (i % 3 != 0) && !(i % 5 == 0))
     cout << i << " is not divisible!" << endl;
```

- *Write Python code that asks for the hour (24-hour time) and greets then with "Good Morning" if before 12, "Good Afternoon" for 12 but not yet 17, and "Good Evening" otherwise.*

- *Write a C++ program that asks the user the number of times they plan to ride transit this week. Your program should then print if it is cheaper to buy single ride metro cards or 7-day unlimited card.*
  (The 7-day card is $31.00, and the cost of single ride, with bonus, is $2.48).

In Pairs or Triples: Conditionals in Python & C++

- *Python: what is the output?*

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year = 2016
if year % 4 == 0 and \
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In Pairs or Triples: Conditionals in Python & C++

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In Pairs or Triples: Conditionals in Python & C++

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  (The 7-day card is $31.00, and the cost of single ride, with bonus, is $2.48).

In Pairs or Triples: Indefinite Loops in Python & C++

Complete as many as possible:

In Pairs or Triples: Indefinite Loops in Python & C++

Complete as many as possible:

- *Python: what is the output?*

```
bal = 100
while bal < 200:
    print("Balance", bal)
    bal = bal + 0.1*bal
```

- *C++: what is the output?*

```
int n = 10;
do {
    if ( n % 2 == 0)
       n = n / 2;
    else
       n = 3*n + 1;
    cout << "n is " << endl;
} while (n > 1);
```

- Write Python code that repeatedly prompts for a non-empty string.
- Write C++ code that repeatedly prompts until an odd number is entered.

In Pairs or Triples: Indefinite Loops in Python & C++

- *Python: what is the output?*

```
bal = 100
while bal < 200:
    print("Balance", bal)
    bal = bal + 0.1*bal
```

In Pairs or Triples: Indefinite Loops in Python & C++

- *C++: what is the output?*

```
int n = 10;
do {
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        n = n / 2;
     else
        n = 3*n + 1;
     cout << "n is " << endl;
} while (n > 1);
```

In Pairs or Triples: Indefinite Loops in Python & C++

- Write Python code that repeatedly prompts for a non-empty string.

In Pairs or Triples: Indefinite Loops in Python & C++

- Write C++ code that repeatedly prompts until an odd number is entered.

Recap: C++ Control Structures

- I/O:

```
//Another C++ program; Demonstrates loops
#include <iostream>
using namespace std;

int main ()
{
  int i,j;
  for (i = 0; i < 4; i++)
  {
      cout << "The world turned upside down...\n";
  }

  for (j = 10; j > 0; j--)
  {
      cout << j << " ";
  }
  cout << "Blast off!!" << endl;

  return 0;
}
```

Recap: C++ Control Structures

- I/O: `cin >> ...;`

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  int i,j;
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Recap: C++ Control Structures

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Recap: C++ Control Structures

- I/O: `cin >> ...;` & `cout << ...;`
- Definite loops:

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}
```

Recap: C++ Control Structures

- I/O: `cin >> ...;` & `cout << ...;`
- Definite loops:

```
for (i = 0; i < 10; i++)
{
    ...
}
```

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using namespace std;

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      cout << j << " ";
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  return 0;
}
```

Recap: C++ Control Structures

- I/O: `cin >> ...;` & `cout << ...;`
- Definite loops:

```
for (i = 0; i < 10; i++)
{
    ...
}
```

- Conditionals:

```
//Another C++ program; Demonstrates loops
#include <iostream>
using namespace std;

int main ()
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  int i,j;
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Recap: C++ Control Structures

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  for (j = 10; j > 0; j--)
  {
      cout << j << " ";
  }
  cout << "Blast off!!" << endl;

  return 0;
}
```

- I/O: `cin >> ...;` & `cout << ...;`
- Definite loops:

```
for (i = 0; i < 10; i++)
{
      ...
}
```

- Conditionals:

```
if (logical expression)
{
      ...
}
else
{
      ...
}
```

Recap: C++ Control Structures

```
//Another C++ program; Demonstrates loops
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using namespace std;

int main ()
{
  int i,j;
  for (i = 0; i < 4; i++)
  {
      cout << "The world turned upside down...\n";
  }

  for (j = 10; j > 0; j--)
  {
      cout << j << " ";
  }
  cout << "Blast off!!" << endl;

  return 0;
}
```

- I/O: `cin >> ...;` & `cout << ...;`
- Definite loops:

```
for (i = 0; i < 10; i++)
{
      ...
}
```

- Conditionals:

```
if (logical expression)
{
      ...
}
else
{
      ...
}
```

- Indefinite loops:

Recap: C++ Control Structures

```
//Another C++ program; Demonstrates loops
#include <iostream>
using namespace std;

int main ()
{
  int i,j;
  for (i = 0; i < 4; i++)
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      cout << "The world turned upside down...\n";
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  for (j = 10; j > 0; j--)
  {
      cout << j << " ";
  }
  cout << "Blast off!!" << endl;

  return 0;
}
```
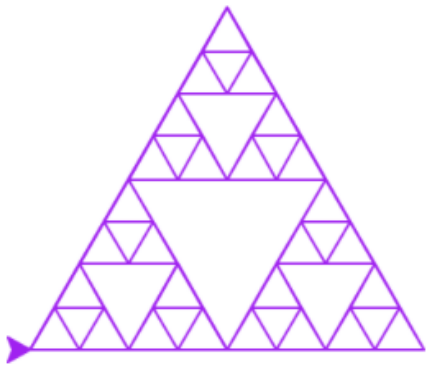

- I/O: `cin >> ...;` & `cout << ...;`
- Definite loops:
  `for (i = 0; i < 10; i++)`
  {
  ...
  }
- Conditionals:
  `if` (*logical expression*)
  {
  ...
  }
  `else`
  {
  ...
  }
- Indefinite loops:
  `while` (*logical expression*)
  {
  ...
  }

Lecture Slips: tinyurl.com/yc2b6jba

In Python, if your main() function and the program output look like this, which function definition should you have for triangle()?

```
def main():
    tess = turtle.Turtle()
    tess.color("purple")
    triangle(tess, 160)
```



```
def triangle(t, side):
    if side > 10:
        for i in range(3):
            t.forward(side)
            t.left(120)
        triangle(t, side/2)
```

○ a)

```
def triangle(t, side):
    if side > 10:
        for i in range(3):
            t.forward(side)
            t.left(120)
            triangle(t, side/2)
```

○ b)

```
def triangle(t, side):
    for i in range(3):
        t.forward(side)
        t.left(120)
        triangle(t, side/2)
```

○ c)

```
def triangle(t, side):
    if side < 10:
        for i in range(3):
            t.forward(side)
            t.left(120)
            triangle(t, side/2)
```

○ d)