n = 5

Compare col 1 to col 2

1 1 2 2 2
3 4 5
3 4
5

< diag attack>
so when \( n = 5 \), must iterate over all 2-element subsets of \( \{1, 2, 3, 4, 5\} \):

\[
\binom{5}{3} = \frac{5!}{3!2!} = 10 \]

\[
\binom{4}{2} = \frac{4!}{2!2!} = 6
\]

\[
\binom{3}{1} = \frac{3!}{1!2!} = 3
\]

\[
\binom{2}{0} = \frac{2!}{0!2!} = 1
\]

Namely:

\[
\begin{align*}
\{1, 2\} & \quad \{3, 4\} \\
\{1, 3\} & \quad \{3, 5\} \\
\{1, 4\} & \quad \{4, 5\} \\
\{1, 5\} & \\
\{2, 3\} & \\
\{2, 4\} & \\
\{2, 5\} & \\
\end{align*}
\]

The number of such sets is:

\[
\frac{5(5-1)}{2} = 10
\]
Chapter 6: Objects \& classes

A class in Java is a new data type, that bundles both data and operations on that data.

What must a class contain?

Ex: class Empty

\[
\]

This is a valid class!
no main() method means it's not a program.

What may a class contain?

- Variables (called member variables or fields)
- Functions (called member methods)
- Other classes
Typically a class represents or imitates some real-world object.

Ex: Person

Person a;

a = new Person();

Person object

name

phone

age

weight
To access fields of Person a,

use member access operator

\[ \text{a.name} \]
\[ \text{a.phoneNumber} \]
\[ \text{a.age} \]
\[ \text{a.weight} \]

Note: \[ \text{a} \] is analogous to \[ \text{[i]} \] for an array.
Ex: Person2

To note:
a static method called from within its class is called like:

```
func_name(...args...);
```

a static method called from outside its class is called like:

```
NameOfClass.func_name(...args...);
```
Recall: two types of methods in Java:

- class method (static method) associated with class itself
define in `myClass`
static type `fun_name(...param...)` if

```java
class otherClass {

  // in some method

  myClass.fun_name(...arg...);
}
```
Instance methods associated with a particular instance of a class define:

class myClass {

    type fun_name (param...)

    ?

}?

}?

call:

class otherClass {

    // in some method
    myClass a = new myClass();

    a.fun_name(...args...);

}?
Every class has a constructor. Often we overload the constructor function.

Often we use the constructor for initialization.
General declaration allocation & initialization:

\[
\text{myClass } x = \text{new myClass(...)};
\]

- class name
- ref/var at type
- myClass
- constructor for myClass
  - typically used for initialization

\[
\text{myClass object}
\]

\[
\text{data values.}
\]
Ex. Person 4

uses multiple constructors

Note: Keyword static applies to variables as well as methods.

A static variable belongs to class as a whole, 'commonly' an instance variable belongs to a particular instance of the class.
static fields are almost always constant

\( \text{static const type var = value} \)

A static non-constant field would be a global variable

\( \text{static type var;} \)

This is bad programming practice.
Inheritance

```
        Object
         /   \
        /     \
Scanner  String  Person
```

Basic fact:

a descendant class inherits all of the members (vars + func) of its ancestor.

There are 11 (public) methods in Object.
Two particular ones:

- `toString()`
- `equals()`

both instance methods.