
Permutations and Combinations

Clicker Question

- A coin is flipped 10 times, producing either heads or tails. How many possible outcomes are there in total?
 - A. 20
 - B. 2^{10}
 - C. 10
 - D. $2^{10}/4$
 - E. 2

Clicker Question

- A coin is flipped 10 times, producing either heads or tails. How many possible outcomes contain exactly two heads?
 - A. 2^8
 - B. 2^2
 - C. $2^{10}/(2^8 \times 2^2)$
 - D. $10!/(2! \times 8!)$
 - E. $10!/2!$

Clicker Question

- A coin is flipped 10 times, producing either heads or tails. How many possible outcomes contain at least three heads?

A. $\binom{10}{3}$

B. $\binom{10}{7}$

C. $\binom{10}{3} + \binom{10}{4} + \binom{10}{5} + \binom{10}{6} + \binom{10}{7} + \binom{10}{8} + \binom{10}{9} + \binom{10}{10}$

D. $2^{10} - 2^3$

Clicker Question

- A coin is flipped 10 times, producing either heads or tails. How many possible outcomes contain the same number of heads and tails?
 - A. $2^{10} / 2$
 - B. $10! / (5! \times 5!)$
 - C. $10! / 5!$
 - D. $10 / 5$

Clicker Question

- How many permutations of $\{a,b,c,d,e,f,g\}$ end with a?
 - A. $7!/6!$
 - B. $7!$
 - C. $6!$
 - D. 7

Clicker Question

- How many permutations of the letters ABCDEFGH contain the substring ABC?
 - A. $8! / 3!$
 - B. $8! / (3! \times 5!)$
 - C. $6!$
 - D. $8! - 3!$

Clicker Question

- How many 10 character (digits and lowercase/uppercase letters) passwords are possible if characters can be repeated?
 - A. 10^{62}
 - B. 62^{10}
 - C. 10×62
 - D. $62!$
 - E. $10!$

Clicker Question

How many 10 character (digits and lowercase/uppercase letters) passwords are possible if characters cannot be repeated?

- A. $62 \times 61 \times 60 \times 59 \times 58 \times 57 \times 56 \times 55 \times 54 \times 53$
- B. $62^{10} - 10^{10}$
- C. $10!$
- D. $62! / 10!$
- E. $62! / (10! \times 52!)$

Inheritance

Clicker Question: Variable accessibility

- A private instance variable can be directly accessed by a subclass of the class in which it was declared.
- A) True
- B) False
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Clicker Question: Variable accessibility

- A protected instance variable can be directly accessed by a subclass of the class in which it was declared.
- A) True
- B) False



Clicker Question: Overriding methods

- A subclass cannot override methods that are inherited from its superclass.
-
- A) True
 - B) False



Clicker Question: What's a superclass?

- The super keyword designates a class as a superclass.
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- A) True
 - B) False



Clicker Question: Single or Multiple inheritance

■ A Java class can extend more than one class

A) True

B) False



Clicker Question: Dynamic binding

- Class Pet, method showTricks, prints (“walk backwards”)
- Subclass Dog extends Pet.
- Dog overrides showTricks, prints (“jump through hoops”)
- Pet p = new Dog();
- What does p.showTricks() do?
 - A. Eclipse complains that showTricks() is defined twice
 - B. Print “jump through hoops”
 - C. Print “walk backwards”
 - D. Eclipse complains that there is a type error because Pet p cannot be a new Dog
 - E. Prints both “jump through hoops” and “walk backwards”

Class exercise on dynamic binding (slides 18-21)

Top

```
public class Top {
    protected int v;
    public Top( int v){
        this.v = v;
    }
    protected int m (){
        System.out.println("Top m() returning Top v: " + v);
        return v;
    }

    // overload m
    protected int m(int p1){
        System.out.println("Top m(p1) returning p1: " + p1 + " + Top v: " + v);
        return p1+v;
    }
}
```

Mid

```
public class Mid extends Top{
    protected int w;
    public Mid(int v, int w){
        super(v);
        this.w = w;
    }

    // override Top m()
    protected int m(){
        System.out.println("Mid m()    returning w: " + w);
        return w;
    }
}
```

Bot

```
public class Bot extends Mid{
    public Bot(int b){
        super(b,1000);
    }
    public int play(){
        System.out.println("Bot play    calling m() and m(500)");
        return m() + m(500);
    }
    public static void main(String[] args){
        Bot b = new Bot(100);
        System.out.println("Bot main    calling play");
        int result = b.play();
        System.out.println("Bot result " + result);
    }
}
```

What does Bot print?

Bot main calling play

Bot play calling m() and m(500)

Mid m() returning w: 1000

Top m(p1) returning p1: 500 + Top v: 100

Bot result 1600
