* function expressions :

```
// Function declaration
function calcAge(birthYear) {
  return 2023 - birthYear;
}

const age = calcAge(2001);
console.log(age);

// Function expression
const calcAge2 = function (birthYear) {
  return 2023 - birthYear;
};

const age2 = calcAge2(2001);
console.log(age2);
```

→ functions are like values similar Number, Boolean, String and these can be stored in variables

* → function declarations are hoisted where as expressions are not.

→ Its a developer's preference.

* Arrow Functions :

```
// Function Declaration
function yearsUntilRetirement1(birthYear, firstName) {
  const age = 2023 - birthYear;
  const retirement = 65 - age;
  return `${firstName} retires in ${retirement} years`;
}
console.log(yearsUntilRetirement1(2001, "Anurag"));

// Function Expression
const yearsUntilRetirement2 = function (birthYear, firstName) {
  const age = 2023 - birthYear;
  const retirement = 65 - age;
  return `${firstName} retires in ${retirement} years`;
};
console.log(yearsUntilRetirement2(2001, "Anurag"));

// Arrow Functions
const yearsUntilRetirement3 = (birthYear, firstName) => {
  const age = 2023 - birthYear;
  const retirement = 65 - age;
  return `${firstName} retires in ${retirement} years`;
};
console.log(yearsUntilRetirement3(2001, "Anurag"));
```

→ not hoisted

→ do not have access to 'this' keyword.

↓

more about 'this' later

```
const checkEven2 = (num) => num % 2 == 0;

/*
const checkEven2 = (num) => {
  return (num % 2) == 0;
}
*/
```

* Objects : (key, value pairs)

```
const myInfoArr = [
  "Anurag",
  "Student",
  2023 - 2001,
  8128039044,
  ["Rahul", "Shiva", "Ram"],
];
console.log(myInfoArr);
console.log(myInfoArr[0], myInfoArr[1]);

const myInfoObj = {
  firstName: "Anurag",
  profession: "Student",
  age: 2023 - 2001,
  phone: 8128039044,
  friends: ["Rahul", "Shiva", "Ram"],
};
console.log(myInfoObj);
console.log(myInfoObj.firstName, myInfoObj.age);
console.log(myInfoObj["firstName"], myInfoObj["age"]);
```

→ In arrays accessing was through order (indexs) of elements, In objects element has a name, value (key, value pairs)
name → key / property

→ {} (obj), [] (arr)

create object, object literal syntax

```
myInfoObj.location = "United States";
myInfoObj["instagram"] = "anurag_nampally";
console.log(myInfoObj);
```

→ you can add some more properties (keys).

Q: print output

"Anurag has ___ (no. of) friends, and ___ (1st friend) is his best friend"

```
console.log(
  `${myInfoObj.firstName} has ${myInfoObj.friends.length} friends, and ${myInfoObj.friends[0]} is his best friend`
);
```

★ Writing functions in Objects and "this" keyword :

```
const myInfoObj = {
  firstName: "Anurag",
  profession: "Student",
  birthYear: 2001,
  phone: 8128039044,
  friends: ["Rahul", "Shiva", "Ram"],
  calcAge: function () {
    this.age = 2023 - this.birthYear;
  },
};

// check whether a property/key exists
if (myInfoObj.age) {
  // undefined => false
  console.log(myInfoObj.age);
} else {
  console.log("Age doesnt exist hence I am calculating it");
  myInfoObj.calcAge();
}

console.log(myInfoObj);
console.log(myInfoObj.age);
```

→ functions are like values hence can be assigned to a property.

→ 'this' means object which is calling the function.

→ arrow functions will have access to the calling object, here this refers to a global level ⇒ a window

Example :

let's use objects to implement the calculations!
Remember: BMI = mass / (height * height) (mass in kg and height in meters).

Your tasks:
For each of them, create an object with properties for their full name, mass, and height (Mark Miller and John Smith).

Name these objects as mark and john, and their properties exactly as fullName, mass and height.

Create a calcBMI method on each object to calculate the BMI (the same method on both objects). Assign the BMI value to a property, and also return it from the method.

Log to the console who has the higher BMI, together with the full name and the respective BMI. Example: "John Smith's BMI (28.3) is higher than Mark Miller's (23.9)!".

```
const mark = {
  fullName: "Mark Miller",
  mass: 78,
  height: 1.69,
  calcBMI: function () {
    this.bmi = this.mass / this.height ** 2;
    return this.bmi;
  },
};

const john = {
  fullName: "John Smith",
  mass: 92,
  height: 1.95,
  calcBMI: function () {
    this.bmi = this.mass / this.height ** 2;
    return this.bmi;
  },
};

mark.calcBMI();
john.calcBMI();

// "John Smith's BMI (28.3) is higher than Mark Miller's (23.9)!"
if (mark.bmi > john.bmi) {
  console.log(
    `${mark.fullName}'s BMI (${mark.bmi.toFixed(2)}) is higher than ${
      john.fullName
    }'s (${john.bmi.toFixed(2)})!`
  );
} else {
  console.log(
    `${john.fullName}'s BMI (${john.bmi.toFixed(2)}) is higher than ${
      mark.fullName
    }'s (${mark.bmi.toFixed(2)})!`
  );
}
```

★ Destructuring Arrays :

1

```
const arr = [2, 3, 4];
const a = arr[0];
const b = arr[1];
const c = arr[2];
console.log(a, b, c);

const [x, y, z] = arr;
console.log(x, y, z);

// its easy to swap two variables
let primary = 12;
let secondary = 23;
console.log(primary, secondary);

[primary, secondary] = [secondary, primary];

console.log(primary, secondary);
```

3

```
// nested destructuring
const nested = [2, 4, [5, [6, 7, 8]]];
const [, , [a, [b, c, d]]] = nested;
console.log(a, b, c, d);

// default values
const [p = 1, q = 1, r = 1] = [8, 9];
console.log(p, q, r);
```

2

```
const library = {
  name: "Book Haven Library",
  location: "123 Main Street, Anytown, USA",
  categories: ["fiction", "non-fiction", "mystery", "drama"],
  fiction: ["FictionBook1", "FictionBook2", "FictionBook3"],
  mystery: ["mysteryBook1", "mysteryBook2", "mysteryBook3"],
  // order will buy two books from fiction
  order: function (fictionIdx1, fictionIdx2) {
    return [this.fiction[fictionIdx1], this.fiction[fictionIdx2]];
  },
};

// retrive 1st two fictional books
console.log(library.fiction[0], library.fiction[1]);
// using destructure
const [first, second] = library.fiction;
console.log(first, second);

// retrive 2nd and 4th categories
console.log(library.categories[1], library.categories[3]);
// using destructure
const [, two, , four] = library.categories;
console.log(two, four);

// how to return more than one value from a function
const [book1, book2] = library.order(1, 2);
console.log(book1, book2);
```

* Destructuring Objects :

☆ Spread operator

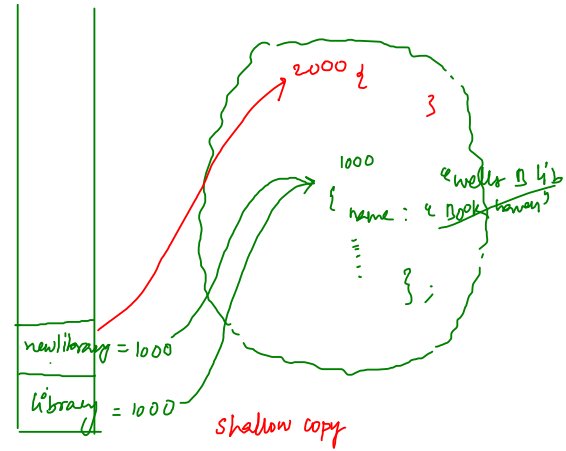
→ We can do deep copy using spread

→ Spread unpacks all individual elements

... [1, 2, 3, 4] → 1 2 3 4

... "Anurag" ⟹ A n u r a g

... { name: "Anurag" ⇒ name: "Anur"
phone: 123456 phone: 123456
}



★ Rest :

... on left side of assignment
(rest)
(packing)

... on right side of assignment
(spread)
(unpacks)

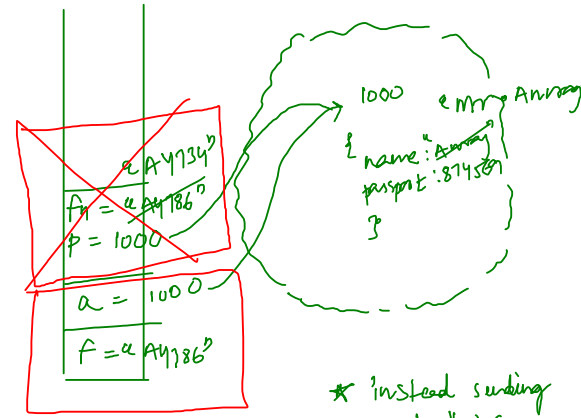
★ pass by ref vs value :

```
552  // Pass by value vs reference
553  const flight = "AY786";
554  const anurag = {
555    name: "Anurag",
556    passport: 874569,
557  };
558
559  const checkIn = function (flightNum, passenger) {
560    flightNum = "AY734";
561    passenger.name = "Mr ." + passenger.name;
562    if (passenger.passport === 874569) {
563      console.log(
564        `Correct passport, hence ${passenger.name} checked In ${flightNum}`
565      );
566    } else {
567      console.log("Incorrect passport, checkIn declined");
568    }
569  };
570
571  checkIn(flight, anurag);
572
573  // function is taking like this...
574  // const flightNum = flight;
575  // const passenger = anurag;
576
577  console.log(flight);
578  console.log(anurag);
```

value

ref

{...anurag}



AY786
{ Mr. Anurag
874569
}

★ instead sending a shallow copy send a deep copy
⇒ {...anurag}
If you dont want changes in original object

★ higher order functions : (because, high level abstraction)

→ A function can accept other function as a parameter, also it can return another function.

```
581  // function accepting fucntions
582  const adder = function (...numbers) {
583    let sum = 0;
584    for (let i = 0; i < numbers.length; i++) {
585      sum = sum + numbers[i];
586    }
587    return sum;
588  };
589
590  const multiplier = function (...numbers) {
591    let prod = 1;
592    for (let i = 0; i < numbers.length; i++) {
593      prod = prod * numbers[i];
594    }
595    return prod;
596  };
597
598  // higher order function
599  const calculator = function (fn, ...numbers) {
600    console.log(fn.name);
601    return fn(...numbers); // call back function
602  };
603
604  const sum1 = calculator(adder, 1, 2, 3, 4, 5);
605  const sum2 = calculator(adder, 1, 2, 3);
606  const prod1 = calculator(multiplier, 1, 2, 3, 4);
607  console.log(sum1, sum2, prod1);
```

→ provides abstraction

→ function which is passed, is called as call-back function.

→ Calculator doesn't know about the implementation details of adder, multiplier.

function returning function

```
609  // function returing functions
610  const greet = function (greeting) {
611    return function (name) {
612      console.log(`${greeting} ${name}`);
613    };
614  };
615
616  /*
617  const greeterHey = greet("Hey");
618  greeterHey("Anurag");
619  */
620
621  greet("Hey")("Anurag");
```

* we are getting 'Hey' due to closure.

1. greet("Hey")
   will return
   function (name) {
     console.log("....");
   }
2. Store the returned function in greeterHey,
   now greeterHey is a function
3. now call greeterHey("Anurag")
   it will call the function which we stored earlier in greeterHey.
   op: "Hey Anurag"