JavaScript learning path

Excellent question 👌 — let's go **under the hood** of how **destructuring actually works** in JavaScript engines (V8, SpiderMonkey, etc.). This will give you the "hidden internals" developers rarely explain.

⚙️ Internals of Destructuring

At its core, **destructuring is just syntactic sugar**.
The engine translates it into **property lookups** and **assignments** during execution.

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1. Array Destructuring Internals

```js
const [a, b] = [10, 20];
```

🔍 Engine expands it roughly like:

```js
let temp = [10, 20];
let a = temp[0];
let b = temp[1];
```

✅ So destructuring is **not magic** — it's just shorthand for indexing.

Advanced Case: Skipping values

```js
const [a, , b] = [10, 20, 30];
```

Internally:

```js

```

```
let temp = [10, 20, 30];
let a = temp[0];
// skip temp[1]
let b = temp[2];
```

⚠ Performance Note: Skipped values are still evaluated, only **not assigned**.

```js
function heavy() { console.log("called"); return 42; }
const [a, , b] = [1, heavy(), 3];
// prints "called" even though skipped
```

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2. Object Destructuring Internals

```js
const { x, y } = { x: 10, y: 20 };
```

Internally:

```js
let temp = { x: 10, y: 20 };
let x = temp.x;
let y = temp.y;
```

Renaming

```js
const { x: foo } = { x: 10 };
```

Internally:

```js
let temp = { x: 10 };
let foo = temp.x;
```

⚠ Notice: `x` does **not** exist as a variable now, only `foo`.

3. Default Values Internals

```js
const [a = 5, b = 10] = [undefined, 20];
```

Internally:

```js
let temp = [undefined, 20];
let a = (temp[0] === undefined) ? 5 : temp[0];
let b = (temp[1] === undefined) ? 10 : temp[1];
```

👉 Default values only trigger on `undefined`, **not null or falsy**.

```js
const [a = 5] = [null];
console.log(a); // null (NOT 5)
```

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4. Nested Destructuring Internals

```js
const { profile: { address: { city } } } = user;
```

Internally:

```js
let temp1 = user.profile;
let temp2 = temp1.address;
let city = temp2.city;
```

⚠ If `user.profile` is `undefined`, this throws → `Cannot read property 'address' of undefined`.

That's why people combine it with:

```js
```

```js
const { profile: { address: { city } = {} } = {} } = user || {};
```

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5. Rest Operator Internals

```js
const { id, ...rest } = { id: 1, name: "Alice", age: 25 };
```

Internally:

```js
let temp = { id: 1, name: "Alice", age: 25 };
let id = temp.id;

// rest collects remaining properties
let rest = {};
for (let key in temp) {
  if (key !== "id") rest[key] = temp[key];
}
```

⚠ Rest is not a simple reference — it **creates a shallow copy** of remaining keys. Changes to `rest` won't affect the original object.

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6. Function Parameter Destructuring Internals

```js
function greet({ name, age }) {
  console.log(name, age);
}
```

Internally, it's like:

```js
function greet(obj) {
  let name = obj.name;
  let age = obj.age;
  console.log(name, age);
}
```

✅ So destructuring here is just "auto unpacking."

🧠 Brain-Bender Internals

Q1. Why does this throw an error?

```js
const { a: { b } } = { a: null };
```

Because engine tries:

```js
let temp = { a: null };
let b = temp.a.b; // ❌ cannot read property 'b' of null
```

Q2. Why does this NOT crash?

```js
const { a: { b } = {} } = {};
console.log(b); // undefined
```

Because engine expands:

```js
let temp = {};
let a = temp.a === undefined ? {} : temp.a;
let b = a.b;
```

⚡ Real Optimization Insight

- Destructuring is **just assignments**. No big runtime overhead.

- But **deep nested destructuring** can create **temporary objects**, costing memory if overused in hot loops.
- Best practice:
  - Use destructuring for clarity at the top-level.
  - For deep paths (like `user.profile.address.city`), use **optional chaining** (`user?.profile?.address?.city`) instead for performance and readability.

👉 Do you want me to now **take those earlier brain-bender questions (Q1, Q2, Q3)** and solve them step by step using these **internals expansion tricks**? That way you'll see how to "simulate the engine" in interviews.