BlockChain

02 Build the Blockchain – Blocks:

Set Up the Blockchain Application:

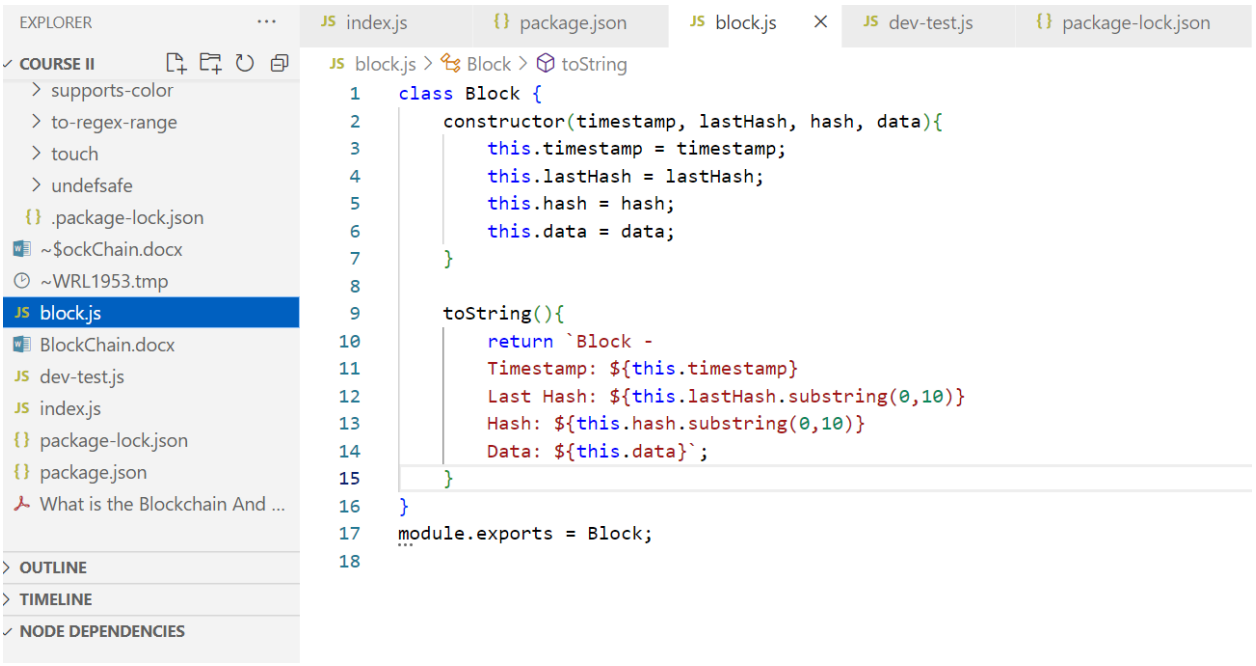
```
C:\Users\Dell>cd C:\Users\Dell\Desktop\BlockChain

C:\Users\Dell\Desktop\BlockChain>cd course II

C:\Users\Dell\Desktop\BlockChain\Course II>npm init -y
Wrote to C:\Users\Dell\Desktop\BlockChain\Course II\package.json:

{
  "name": "course-ii",
  "version": "1.0.0",
  "description": "",
  "main": "index.js",
  "scripts": {
    "test": "echo \"Error: no test specified\" && exit 1"
  },
  "keywords": [],
  "author": "",
  "license": "ISC"
}



C:\Users\Dell\Desktop\BlockChain\Course II>npm i nodemon --save-dev

added 32 packages, and audited 33 packages in 2s

3 packages are looking for funding
  run `npm fund` for details

found 0 vulnerabilities

C:\Users\Dell\Desktop\BlockChain\Course II>
```

BlockChain

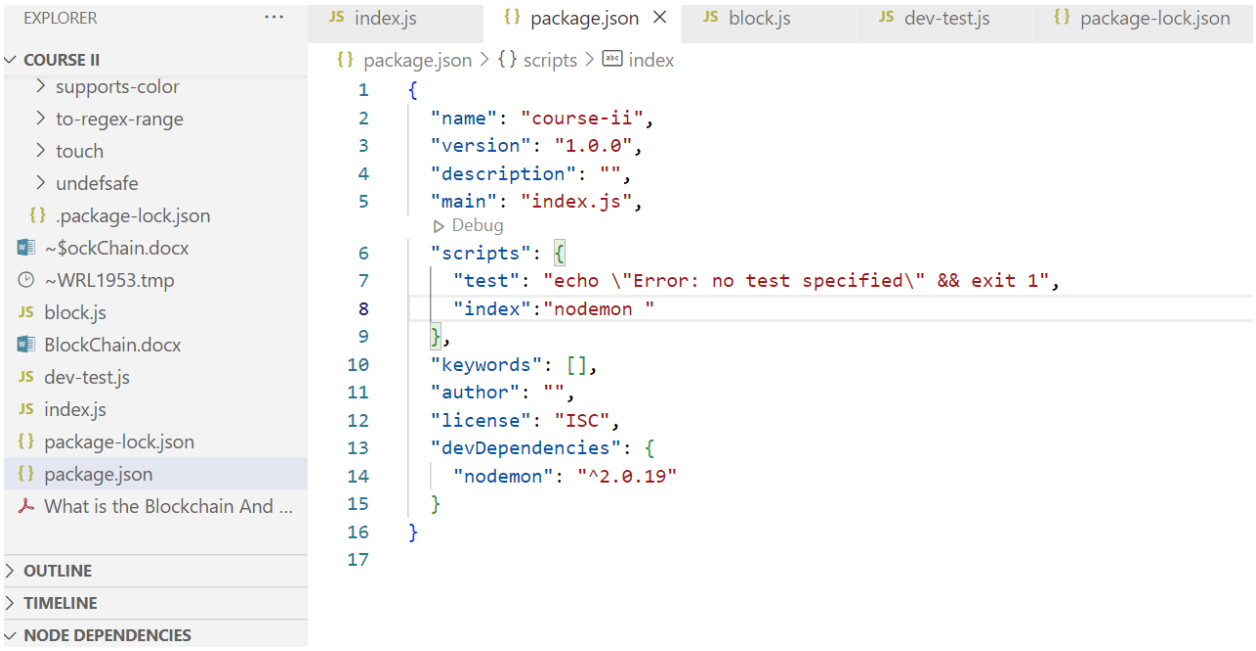
Create a Block:

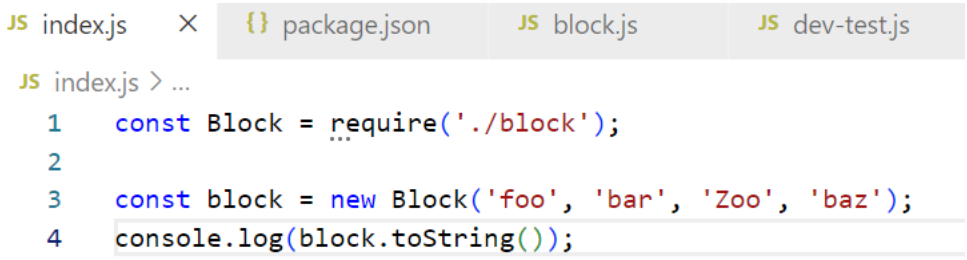
Block

- Timestamp in milliseconds.
- lastHash - the hash of the block before it.
- hash - based on its own data.
- The data to store.



BlockChain

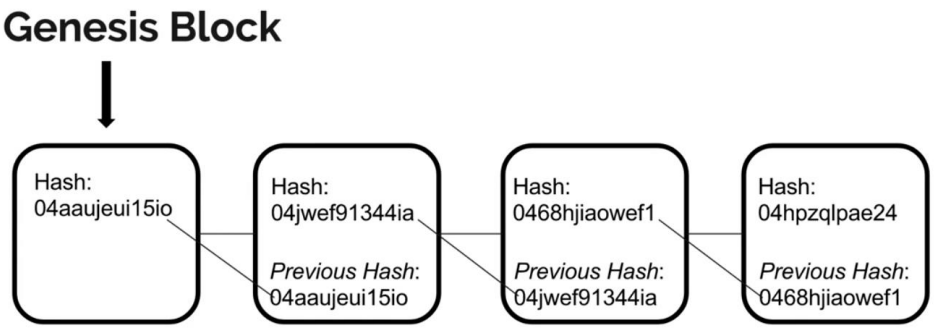





```
C:\Users\Dell\Desktop\BlockChain\Course II>npm run index

> course-ii@1.0.0 index
> nodemon

[nodemon] 2.0.19
[nodemon] to restart at any time, enter `rs`
[nodemon] watching path(s): *.*
[nodemon] watching extensions: js,mjs,json
[nodemon] starting `node index.js`
Block -
        Timestamp: foo
        Last Hash: bar
        Hash: Zoo
        Data: baz
[nodemon] clean exit - waiting for changes before restart
```

BlockChain

Genesis Block:




```
    static genesis(){
        return new this('Genesis time', '-----', 'f1r57-h45h',[]);
    }
}
```

```
const block = new Block('foo', 'bar', 'Zoo', 'baz');
console.log(block.toString());
console.log(Block.genesis().toString());
```

```
C:\Users\Dell\Desktop\BlockChain\Course II>npm run index

> course-ii@1.0.0 index
> nodemon

[nodemon] 2.0.19
[nodemon] to restart at any time, enter `rs`
[nodemon] watching path(s): *.*
[nodemon] watching extensions: js,mjs,json
[nodemon] starting `node index.js`
Block -
        Timestamp: foo
        Last Hash: bar
        Hash: Zoo
        Data: baz
Block -
        Timestamp: Genesis time
        Last Hash: -----
        Hash: f1r57-h45h
        Data:
[nodemon] clean exit - waiting for changes before restart
```

BlockChain

Mine Blocks:

```
static mineBlock(lastBlock, data){
    const timestamp = Date.now();
    const lastHash = lastBlock.hash;
    const hash = 'todo-hash';

    return new this(timestamp, lastHash, hash, data);

}
```

```
const fooBlock = Block.mineBlock(Block.genesis(), 'foo');
console.log(fooBlock.toString());
```

```
[nodemon] restarting due to changes...
[nodemon] starting `node index.js`
Block -
        Timestamp: 1661751440935
        Last Hash: f1r57-h45h
        Hash: todo-hash
        Data: foo
[nodemon] clean exit - waiting for changes before restart
```

BlockChain

SHA256 Hash Function:

Block Hashes and SHA-256

- The hash is generated from the timestamp, lastHash, and stored data.
- We'll use an algorithm called SHA-256.
  - Produces a unique 32-byte (256 bit) hash value for unique data inputs.
  - One-way hash.
- Useful for block validation.

```
C:\Users\Dell\Desktop\BlockChain\Course II>npm i crypto-js --save

added 1 package, and audited 34 packages in 848ms

3 packages are looking for funding
  run `npm fund` for details

found 0 vulnerabilities
```

```
const SHA256 = require('crypto-js/sha256');

 static mineBlock(lastBlock, data){
     const timestamp = Date.now();
     const lastHash = lastBlock.hash;
     const hash = Block.hash(timestamp, lastHash, data);

     return new this(timestamp, lastHash, hash, data);

 }
```

```
static hash(timestamp, lastHash, data){
    return SHA256(`${timestamp}${lastHash}${data}`).toString();

}
```

```
[nodemon] 2.0.19
[nodemon] to restart at any time, enter `rs`
[nodemon] watching path(s): *.*
[nodemon] watching extensions: js,mjs,json
[nodemon] starting `node index.js`
Block -
        Timestamp: 1661752741755
        Last Hash: f1r57-h45h
        Hash: 0ca2b0c81a
        Data: foo
[nodemon] clean exit - waiting for changes before restart
```

BlockChain

Test the Block:

```
C:\Users\Dell\Desktop\BlockChain\Course II>npm i jest --save-dev

added 275 packages, and audited 309 packages in 14s

32 packages are looking for funding
  run `npm fund` for details

found 0 vulnerabilities

C:\Users\Dell\Desktop\BlockChain\Course II>
```

```
Test Suites: 1 passed, 1 total
Tests:       2 passed, 2 total
Snapshots:   0 total
Time:        0.735 s, estimated 1 s
Ran all test suites.

Watch Usage: Press w to show more.
```

```
"scripts": {
  "test": "jest --watchAll",
  "index": "nodemon "
},
```

JS block.test.js > ...

```
1   // const { expect } = require('@babel/types');
2   // const { it } = require('node:test');
3   // const { describe } = require('yargs');
4   const Block = require('./block');
5
6   describe('Block', () => {
7
8       let data, lastBlock, block;
9
10      beforeEach(()=> {
11          data = 'bar';
12          lastBlock = Block.genesis();
13          block = Block. mineBlock(lastBlock,data);
14      });
15      it('sets the `data` to match the input', ()=> {
16          expect(block.data).toEqual(data);
17      });
18
19      it('sets the `lastHash` to match the hash of the last block', ()=> {
20
21          expect(block.lastHash).toEqual(lastBlock.hash);
22
23
24      });
25  });
```

BlockChain