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How SHA-1 Works

1. Take input text and split it into an array of the characters' ASCII codes

'A Test'

[A, , T, e, s, t]

```
function sha1(text) {  
  const asciiText = text.split('')  
  .map((letter) => utils.charToASCII(letter));  
}
```

[65, 32, 84, 101, 115, 116]

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How SHA-1 Works

2. Convert ASCII codes to binary

3. Pad zeros to the front of each until they are 8 bits long

[65, 32, 84, 101, 115, 116]

```
let binary8bit = asciiText  
  .map((num) => utils.asciiToBinary(num))  
  .map((num) => utils.padZero(num, 8));
```

[01000001, 00100000,
01010100, 01100101,
01110011, 01110100]

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11. loop through each 'chunk' array of sixteen 32-bit 'words' and extend each array to 80 'words' using bitwise operations

```
//chunkWords is an array of 'chunk' subarrays
const words80 = chunkWords.map(chunk => {
  //we start with a 'chunk' array of 16 32-bit 'words'
  for (let i = 16; i <= 79; i++) {
    //take four words from that chunk using
    //your current i in the loop
    const wordA = chunk[i - 3];
    const wordB = chunk[i - 4];
    const wordC = chunk[i - 14];
    const wordD = chunk[i - 16];

    //perform consecutive XOR bitwise
    //operations going through each word
    const word = utils.xor(wordA, wordB);
    const wordC = utils.xor(wordC, wordD);
    const wordD = utils.xor(wordC, word);

    //left rotate by one
    const newWord = utils.leftRotate(wordC, 1);
    //append to the array and continue the loop
    chunk.push(newWord);
  }
  return array;
});
```

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12. initialize some variables

```
let h0 = '01100111010001010010001100000001';
let h1 = '111011110010101010110001001';
let h2 = '100100010110101011001111110';
let h3 = '000100000110010101000110110';
let h4 = '110000111010010111000011110000';
let a = h0;
let b = h1;
let c = h2;
let d = h3;
let e = h4;
```

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13. looping through each chunk: bitwise operations and variable reassignment

```
for (let i = 0; i < chunks.length; i++) {
  for (let j = 0; j < 80; j++) {
    let h;
    if (j < 20) {
      const h0 = utils.add(utils.add(h1, h2), h3);
      h = utils.add(h0, h4);
    } else if (j < 40) {
      const h0 = utils.add(h1, h2);
      const h1 = utils.add(h3, h4);
      h = utils.add(h0, h1);
    } else if (j < 60) {
      const h0 = utils.add(h1, h2);
      const h1 = utils.add(h3, h4);
      const h2 = utils.add(h0, h1);
      const h3 = utils.add(h0, h1);
      h = utils.add(h2, h3);
    } else {
      const h0 = utils.add(h1, h2);
      const h1 = utils.add(h3, h4);
      const h2 = utils.add(h0, h1);
      const h3 = utils.add(h0, h1);
      const h4 = utils.add(h2, h3);
      h = utils.add(h0, h4);
    }
    const temp = utils.add(h, 0x1000000000000000n);
    const h0 = utils.add(h, temp);
    const h1 = utils.add(h, temp);
    const h2 = utils.add(h, temp);
    const h3 = utils.add(h, temp);
    const h4 = utils.add(h, temp);
    h = utils.add(h, temp);
  }
}
```

h0 = 01100111010001010010001100000001
h1 = 11101111100101010101010110001001
h2 = 10010001010101010101010111111110
h3 = 00010000001100100101010001110110
h4 = 11000011110100101110000111110110

h0 = 10001111000011000000100001010101
h1 = 100100010101010001001111100100
h2 = 1010011110111100001100101000110
h3 = 10001011001110000111010011001000
h4 = 100100000011101111000001000011

return {h0, h1, h2, h3, h4}.
.map((string) => utils.binaryToHex(string)).
.join('');

h0 = 8f0c855
h1 = 915633e4
h2 = a7de1946
h3 = 8b3874c8
h4 = 901df043

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14. convert each of the five resulting variables to hexadecimal
15. join them together and return it!

```
return {h0, h1, h2, h3, h4}.  
.map((string) => utils.binaryToHex(string)).  
.join('');
```

h0 = 10001111000011000000100001010101
h1 = 100100010101010001001111100100
h2 = 1010011110111100001100101000110
h3 = 10001011001110000111010011001000
h4 = 100100000011101111000001000011

h0 = 8f0c855
h1 = 915633e4
h2 = a7de1946
h3 = 8b3874c8
h4 = 901df043

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Your hash value!

8f0c0855915633e4a7de19468b3874c8901df043

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