```
//FIRST CLASS FUNCTIONS

/* When functions can be treated like any other
variable then those functions are first-class
functions. There are many other programming
languages, for example, scala, Haskell, etc which
follow this including JS. Now because of this
function can be passed as a param to another
function(callback) or a function can return another
function(higher-order function). map() and filter()
are higher-order functions that are popularly used.
*/

//NODEJS

/* Node.js is a virtual machine that uses
JavaScript as its scripting language and runs
Chrome's V8 JavaScript engine. It is based on an
event - driven architecture where I / O runs
asynchronously making it lightweight and efficient.
Node.js provides simplicity in development because
of its non - blocking I / O and event - based model
results in short response time and concurrent
processing, unlike other frameworks where
developers have to use thread management. It runs
on a chrome v8 engine which is written in c++ and
is highly performant with constant improvement. */
```

```
//NODEJS CONTROL FLOW

/*
https://medium.com/@gunendu/control-flow-in-nodejs-
8e855996a5c7 */

//TIMERS

/* setTimeout() can be used to schedule code
execution after a designated amount of
milliseconds. It accepts a function to execute as
its first argument and the millisecond delay
defined as a number as the second argument.
Additional arguments may also be included and these
will be passed on to the function. Here is an
example of that: */

function myFunc(arg) {
   console.log(`arg was => ${arg}`);
}

setTimeout(myFunc, 1500, 'funky');

/* The above function myFunc() will execute a
minimum of 1500 milliseconds later due to the call
of setTimeout(). The timeout interval that is set
cannot be relied upon to execute after that exact
number of milliseconds.This is because other
```

```
executing code that blocks or holds onto the event
loop will push the execution of the timeout back.
The only guarantee is that the timeout will not
execute sooner than the declared timeout interval.
setTimeout() returns a Timeout object that can be
used to reference the timeout that was set.This
returned object can be used to cancel the timeout
as well as change the execution behavior.

setImmediate() will execute code at the end of the
current event loop cycle. This code will execute
after any I/O operations in the current event loop
and before any timers scheduled for the next event
loop. This code execution could be thought of as
happening "right after this", meaning any code
following the setImmediate() function call will
execute before the setImmediate() function
argument. The first argument to setImmediate() will
be the function to execute. Any subsequent
arguments will be passed to the function when it is
executed. Here's an example: */

console.log('before immediate');

setImmediate((arg) => {
   console.log(`executing immediate: ${arg}`);
}, 'so immediate');
```

```
console.log('after immediate');

/* The above function passed to setImmediate() will
execute after all runnable code has executed, and
the console output will be:

before immediate
after immediate
executing immediate: so immediate

setImmediate() returns an Immediate object, which
can be used to cancel the scheduled immediate.

If there is a block of code that should execute
multiple times, setInterval() can be used to
execute that code. setInterval() takes a function
argument that will run an infinite number of times
with a given millisecond delay as the second
argument. Just like setTimeout(), additional
arguments can be added beyond the delay, and these
will be passed on to the function call. Also like
setTimeout(), the delay cannot be guaranteed
because of operations that may hold on to the event
loop, and therefore should be treated as an
approximate delay. See the below example: */

function intervalFunc() {
   console.log('Cant stop me now!');
```

```
}

setInterval(intervalFunc, 1500);

/* In the above example, intervalFunc() will
execute about every 1500 milliseconds, or 1.5
seconds, until it is stopped. Just like
setTimeout(), setInterval() also returns a Timeout
object which can be used to reference and modify
the interval that was set.

What can be done if a Timeout or Immediate object
needs to be cancelled? setTimeout(),
setImmediate(), and setInterval() return a timer
object that can be used to reference the set
Timeout or Immediate object. By passing said object
into the respective clear function, execution of
that object will be halted completely. The
respective functions are clearTimeout(),
clearImmediate(), and clearInterval(). See the
example below for an example of each: */

const timeoutObj = setTimeout(() => {
   console.log('timeout beyond time');
}, 1500);

const immediateObj = setImmediate(() => {
   console.log('immediately executing immediate');
```

```
});

const intervalObj = setInterval(() => {
   console.log('interviewing the interval');
}, 500);

clearTimeout(timeoutObj);
clearImmediate(immediateObj);
clearInterval(intervalObj);

//CHILD PROCESS

/* The spawn function launches a command in a new
process and we can use it to pass that command any
arguments. For example, here's code to spawn a new
process that will execute the pwd command. */

const { spawn } = require('child_process');

const child = spawn('pwd');

/* We simply destructure the spawn function out of
the child_process module and execute it with the OS
command as the first argument.

The fork function is a variation of the spawn
function for spawning node processes. The biggest
difference between spawn and fork is that a
```

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communication channel is established to the child
process when using fork, so we can use the send
function on the forked process along with the
global process object itself to exchange messages
between the parent and forked processes. We do this
through the EventEmitter module interface. */

//API FUNCTIONS

/* There are two types of API functions:
Asynchronous, non-blocking functions - mostly I/O
operations which can be fork out of the main loop.
Synchronous, blocking functions - mostly operations
that influence the process running in the main
loop. */

//ASYNC.QUEUE()

/* The async module is designed for working with
asynchronous JavaScript in NodeJS. The async.queue
returns a queue object which is capable of
concurrent processing i.e processing multiple items
at a single time. Example: */

const queue = async.queue((task, completed) => {
   /* Here task is the current element being
   processed and completed is the callback function
*/
```

```
   console.log("Currently Busy Processing Task " +
task);

   // Simulating a complex process.
   setTimeout(() => {
       // Number of elements to be processed.
       const remaining = queue.length();
       completed(null, { task, remaining });
   }, 1000);

}, 1);

/* The concurrency value is set to one,
Which means that one element is being
Processed at a particular time */

//EVENT LOOP

/*
https://www.geeksforgeeks.org/node-js-event-loop/

The main loop is single-threaded and all async
calls are managed by libuv library. This is because
libuv sets up a thread pool to handle such
concurrency. How many threads will be there in the
thread pool depends upon the number of cores but
you can override this. */
```

```
//nextTick()

/* Every time the event loop takes a full trip, we
call it a tick. When we pass a function to
process.nextTick(), we instruct the engine to
invoke this function at the end of the current
operation, before the next event loop tick starts:
*/

process.nextTick(() => {
   //do something
})

/* The event loop is busy processing the current
function code. When this operation ends, the JS
engine runs all the functions passed to nextTick
calls during that operation. It's the way we can
tell the JS engine to process a function
asynchronously (after the current function), but as
soon as possible, not queue it. Calling
setTimeout(() => {}, 0) will execute the function
at the end of next tick, much later than when using
nextTick() which prioritizes the call and executes
it just before the beginning of the next tick. Use
nextTick() when you want to make sure that in the
next event loop iteration that code is already
executed. */
```

```
//ASYNC AWAIT

/*
https://nodejs.dev/learn/modern-asynchronous-javascript-with-async-and-await */

//EventEmitter

/* the interaction of the user is handled through events: mouse clicks, keyboard button presses, reacting to mouse movements, and so on. On the backend side, Node.js offers us the option to build a similar system using the events module. This module, in particular, offers the EventEmitter class, which we'll use to handle our events. */

const eventEmitter = new (require('events'))();

/* This object exposes, among many others, the on and emit methods.

Emit is used to trigger an event
on is used to add a callback function that's going to be executed when the event is triggered
```

```
For example, let's create a start event, and as a
matter of providing a sample, we react to that by
just logging to the console: */

eventEmitter.on('start', number => {
   console.log(`started ${number}`)
});

eventEmitter.emit('start', 23);

/* the event handler function is triggered, and we
get the console log. The EventEmitter object also
exposes several other methods to interact with
events, like

once(): add a one-time listener

removeListener() / off(): remove an event listener
from an event

removeAllListeners(): remove all listeners for an
event */

//STREAM

/* https://nodejs.dev/learn/nodejs-streams */

//BUFFERS
```

```
/* https://nodejs.dev/learn/nodejs-buffers */

//MIDDLEWARE

/* Middleware comes in between your request and
business logic. It is mainly used to capture logs
and enable rate limit, routing, authentication,
basically whatever that is not a part of business
logic. There are third-party middleware also such
as body-parser and you can write your own
middleware for a specific use case. */
```