TSR	First Parcial	Units 1,2,3	2018-11-07	A

This test provides 2 points (20%) of the global grade in NIST and it consists of 20 questions. Each question has 4 choices and only one of them is correct. Each correct answer provides 0.1 points and each error -0.033 points. Answers must be given in a separate answer sheet. The exercise mark is 1 point and its answer must be given in the blank sheets delivered with this wording.

1 *In cloud computing, PaaS provides DO NOT have to:*

- **a** Manage service deployment and upgrading.
- **b** Set elasticity points.
- **c** Monitor workload-related parameters.
- **d** Install virtual machines.

2 *In the Wikipedia development, reverse proxies have been used in order to:*

- **a** Guarantee reliability and fault tolerance in its web servers.
- **b** Accelerate dynamic requests to the database management servers.
- **c** Become intermediaries (i.e., brokers) between web servers and database management servers, balancing the workload among the database server replicas.
- **d** Provide endpoints to service users, balancing the workload among web servers.

3 *An asynchronous server (AS) may scale better than a multi-threaded server (MTS) because…*

- **a** AS guarantees strong consistency and MTS provides weak consistency.
- **b** AS uses persistent communication and MTS must use transient (i.e., non-persistent) communication.
- **c** Some MTS activities may block when multiple threads access the same shared data element.
- **d** MTS cannot use asynchronous communication.

4 *Regarding the distributed system model:*

- **a** It is composed of a set of cooperating agents. Those agents do not have any independent state.
- **b** A distributed system is not necessarily a networked system.
- **c** Each agent is a sequential process.
- **d** It compels all system agents to proceed at the same pace.

5 *Let us assume that this program runs in a directory that does not have any file with a .txt extension. Choose the correct program output:*

```
const fs = require('fs')
function afterRead(n) {
  return function(err, data) {
    if (err) console.error(n, 'not found')
    else console.log(data.toString())
  }
}
function startReading(n) {
  return function() { fs.readFile(n, afterRead(n)) }
}
for (var i = 1; i <= 2; i++) {
  fs.writeFileSync('data' + i + '.txt', 'Hello ' + i)
}
for (var i = 1; i <= 3; i++) {
  var filename = 'data' + i + '.txt'
  var time = 100 − 10 ∗ i
  setTimeout(startReading(filename), time)
}
console.log("root(" + i + ") =", Math.sqrt(i))
```

a Hello 1
Hello 2
data3.txt not found
root(4) = 2

b root(4) = 2
data3.txt not found
data3.txt not found
data3.txt not found

c root(4) = 2
Hello 1
Hello 2
data3.txt not found

d root(4) = 2
data3.txt not found
Hello 2
Hello 1

6 *Let us assume that this program runs in a directory that does not have any file with a .txt extension. Choose the correct program output:*

```
const fs = require('fs')
function afterReading(n) {
  return function(err, data) {
    if (err) console.error(n, 'not found')
    else console.log(data.toString())
  }
}
for (var i = 1; i <= 2; i++) {
  fs.writeFileSync('data' + i + '.txt', 'Hello ' + i)
}
for (var i = 1; i <= 3; i++) {
  var name = 'data' + i + '.txt'
  var time = 100 − 10 ∗ i
  setTimeout(function() {
    fs.readFile(name, afterReading(name))
  }, time)
}
console.log("root(" + i + ") =", Math.sqrt(i))
```

a Hello 1
Hello 2
data3.txt not found
root(4) = 2

b root(4) = 2
data3.txt not found
data3.txt not found
data3.txt not found

c root(4) = 2
Hello 1
Hello 2
data3.txt not found

d root(4) = 2
data3.txt not found
Hello 2
Hello 1

7 *The statement that defines in the best way (among those presented in this question) what is a callback is…*

a …the result of a call to a function, when that result is also a function.

b …the protocol needed by a client browser for interacting with the Wikipedia servers.

c …a feature in JavaScript where an inner function has access to the outer (enclosing) function's variables or arguments.

d …is a function A that is passed as a parameter to another function B, and A is run when B ends in order to process B's results.

8 *On the declaration scope of JavaScript variables:*

a A variable declared with 'let' is local to the function where it has been declared.

b A variable declared with 'var' is local to the block where it has been declared.

c A variable that is implicitly declared (without 'let' or 'var') in a function, is accessible from the entire file.

d Scopes are scanned from the most external to the most internal.

9 *About type management in JavaScript:*

a We do not need to define a local variable (in a function) before using it.

b When a variable is defined, we must assign an initial value to it.

c When a variable is defined, we must specify its type.

d In its lifetime, a variable may hold values of different types.

10 *About JavaScript functions:*

a An anonymous function is a value that can be assigned, passed as an argument or returned as a result.

b Inside functions, we may declare other functions, but only when the latter are anonymous functions.

c A function may have multiple return values.

d The number of parameters in a function declaration must be equal to the number of arguments used when it is called.

11 *About JavaScript closures:*

a A closure is a function that returns another function as its result.

b A closure is a function that remembers the scope where it has been created.

c It is impossible to define a closure with arguments.

d A closure can only access its arguments, its local variables and the global variables.

12 *About events:*

a NodeJS uses an execution thread for its main code and it starts an auxiliary thread per managed event.

b There is an event queue that represents ended activities.

c We may only associate an answer to each given event.

d A new event cannot be managed, at least, until the management of the current one ends.

13 *Let us assume a chat service developed in NodeJS+ZeroMQ, with two communication channels: a PUB/SUB in order to broadcast messages from the server to all clients, and a PUSH/PULL in order to forward typed-in client messages to the server.*
Now, we must rewrite this service in order to use a single socket (instead of two) in each program. The best option is:

a The client uses a REQ socket, and the server uses a REP.

b The client uses a ROUTER socket, and the server uses a DEALER.

c The client uses a DEALER socket, and the server uses a ROUTER.

d None. No solution exists with a single socket per program.

14 *We want to implement a group membership service using NodeJS+ZeroMQ. Each process is placed in a different computer: it periodically sends a* `heart-beat` *message to all other processes, and listens to the* `heart-beat` *messages from the other participants. Every process uses the same port number and knows the IP addresses of the other processes.*
In order to implement this service, choose the best option:

a Every process defines a socket r of type ROUTER, uses r.bind(…), and for each URL of other processes uses r.connect(…)

b Every process defines sockets p of type REP and q of type REQ, uses p.bind(…) and for each URL of other processes uses q.connect(…)

c Every process defines a socket q of type REQ, uses q.bind(…) and for each URL of other processes uses q.connect(…)

d Every process defines sockets p of type PUB and s of type SUB, uses p.bind(…) and for each URL of other processes uses s.connect(…)

15 *Let us assume these programs. Once this command line is started,* `$ node client & node server 8888 &`*, then the following sentence is true:*

```
// client.js
const zmq=require('zmq')
const rq=zmq.socket('dealer')
rq.connect('tcp://127.0.0.1:8888')
rq.connect('tcp://127.0.0.1:8889')
for (let i=1; i<=100; i++) {
  rq.send(['', i])
  console.log("Sending %d",i)
}
rq.on('message',function(del,req,rep){
  console.log("%s: %s",req,rep)
})
```

```
// server.js
const zmq = require('zmq')
const rp = zmq.socket('rep')
let port = process.argv[2]
rp.bindSync('tcp://127.0.0.1:'+port)
rp.on('message', function(msg) {
  let j = parseInt(msg)
  rp.send([msg,(j*3).toString()])
})
```

a That server receives and correctly manages all the requests sent by that client.

b The client gets immediately blocked since it must interact with two servers, and there is only one in this example.

c The first few requests are lost since the client has been started before the first server was started.

d That server receives and correctly manages 50 of the requests sent by that client.

16 *Let us assume these programs. Let us consider that port 8888 is initially unbound. Once this command line is started,* `$ node client & node server 8888 &`*, then the following sentence is true:*

```
// client.js
const zmq=require('zmq')
const rq=zmq.socket('dealer')
rq.bindSync('tcp://127.0.0.1:8888')
for (let i=1; i<=100; i++) {
  rq.send(['', i])
  console.log("Sending %d",i)
}
rq.on('message',function(del,req,result){
  console.log("%s: %s",req,result)
})
```

```
// server.js
const zmq = require('zmq')
const rp = zmq.socket('rep')
let port = process.argv[2]
rp.connect('tcp://127.0.0.1:'+port)
rp.on('message', function(msg) {
  let j = parseInt(msg)
  rp.send([msg,(j*3).toString()])
})
```

a That server receives and correctly manages all the requests sent by that client.

b No communication is possible in this example, since DEALER sockets may only interact with ROUTER sockets and REP sockets may only interact with REQ sockets.

c No communication is possible in this example, since client processes cannot use the bind() operation. They must only use connect().

d Replies are not correctly shown by the client, since its `result` parameter in the `'message'` listener is always `undefined.`

17 *Let us consider a connection between two DEALER sockets. Which of these sentences is correct?*

a That communication pattern is invalid since it is not allowed by ZeroMQ.

b The bound DEALER can only reply to the messages sent by the other DEALER.

c Both DEALER sockets may send messages at any time and in any format. There is no constraint.

d Messages sent by both DEALER sockets must include, at least, an empty segment. There is no other constraint.

18 *About bind/connect:*

a If connect() precedes bind(), then the agent that has tried connect() is aborted.

b Except for PUB/SUB sockets, all other sockets do not accept multiple connect() onto a single bind().

c With PUSH/PULL, multiple connect() cannot be done onto a single bind().

d A single REQ socket may connect onto multiple REP sockets.

19 *About multi-segment message structure:*

a A ROUTER socket does not alter the structure of the sent messages.

b A REQ socket does not alter the structure of the sent messages.

c A DEALER socket modifies the structure of the received messages.

d A ROUTER socket modifies the structure of the received messages.

20 *About the incoming and outgoing message queues in ZeroMQ sockets:*

a A PUSH socket has one incoming queue and one outgoing queue.

b A DEALER socket only has an incoming message queue.

c A REQ socket has a pair of incoming and outgoing queues per agent connected to it.

d A ROUTER socket has a pair of incoming and outgoing queues per agent connected to it.

NIST

Let us consider these programs:

```
// producer.js
const zmq = require('zmq')
let psh = zmq.socket('push')
psh.bind('tcp://*:8001')
let i = 0
let handler =
  setInterval(function() {
    psh.send(''+ ++i)
    if (i == 150) {
        clearInterval(handler)
        psh.close()
        process.exit()
    }
}, 100)
```

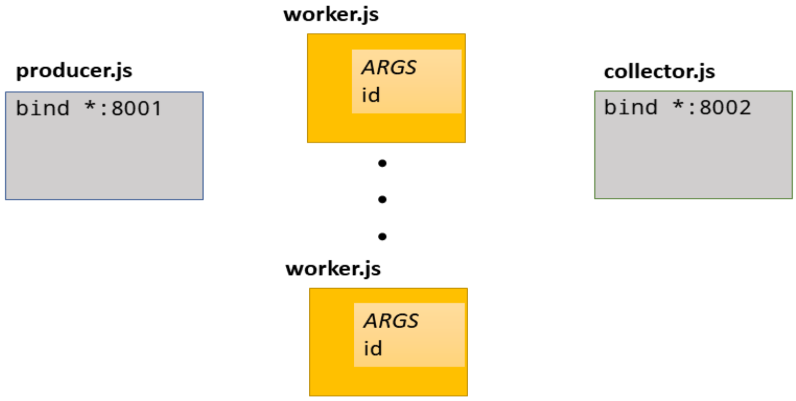
```
// collector.js
const zmq = require('zmq')
let pull = zmq.socket('pull')
pull.bind('tcp://*:8002')
pull.on('message',
  function(w, n, m) {
    console.log('[w' + w
      + '] fact(' + n +') = ' + m)
})
```

```
// myMath.js
function fact(n) {
  if (n < 2) return 1
  else return n * fact(n - 1)
}
exports.fact = fact
```

These programs belong to an incomplete *pipeline* (1:*n*:1) that should distribute the computation of the factorials of the first 150 integer numbers among ***n*** worker components.

<u>You must implement</u> that ***worker*** component in order to provide such functionality, considering that the ***worker***:

- Has to receive (from the command line) a value, to be used as its identifier.
- Has to connect to the ***producer*** and the ***collector*** using the appropriate sockets.
- For each delivered message, it should forward through the pipeline a multi-segment message that includes its worker identifier, the received number and the factorial of that number.



This part provides 1 point to your global NIST grade. It consists of 10 multiple choice questions. Each question has 4 choices and a single correct answer. Each correct answer provides 0.1 points and each error -0.033 points. Answers must be delivered in a separate specific sheet.

The programs in this first page correspond to:

1 The auxiliary module auth.js

2 File ej.js, that uses such a module (with numbered lines)

Both files are mentioned in the questions. We recommend that you separate this first sheet in order to easily read it when you answer those questions.

```
// auth.js
const fs=require("fs")
const file_pw = './passwd.json'
const errlec='Error reading passwd file'
const errlog='Incorrect username/passwd'
function check_login(u,ok) {
   return u.user==ok.user && u.pass==ok.pass
}
function doCheckPasswd(u, f_err, f_succ) {
   fs.readFile(file_pw,"utf8",(err,data)=>{
      if(err) f_err(errlec)
      else
         if (!check_login(u, JSON.parse(data)))
            f_err(errlog)
         else f_succ()
   })
}
exports.doCheckPasswd = doCheckPasswd
```

```
const net  = require("net")
const auth = require("./auth.js")
var c = 0
var arg=process.argv.slice(2)
var mc= arg[0]*1, A1= arg[1], A2= arg[2]

const proxy = net.createServer((soc)=>{
   var sg = 0, s, ssC = false
   function w(r,m) {
      soc.write(JSON.stringify({res:r,mens:m}))
   }
   function procesa(msg) {

      var obj = JSON.parse(msg)
      switch (sg) {
      case 0:
         if (obj.op == "login") {w("OK"); sg++}
         else w("err")
         break
      case 1:
         auth.doCheckPasswd(obj,
            m  => {w("login err",m)},
            () => {sg++; w("login ok")})
         break
      case 2:
         if (ssC) s.write(msg)
         else {
            s = new net.Socket()
            s.connect(A2,A1, () => {
               ssC = true; s.write(msg)
               s.on("data", (m)=>{soc.write(m)})
               s.on("end",  () =>{soc.end()})
            })
         } // else
      } // switch
   } // procesa
   if (c >= mc) soc.close() //demasiadas conex
   c++ // cliente conectado
   soc.on("data", procesa)
   soc.on("end",  (m)=>{c=c-1})
}).listen(8000)
```

1 *Regarding the* `auth.js` *module, which of the following functions is invoked with some callback argument?*

a check_login

b doCheckPasswd

c f_err

d f_succ

2 *The code of* `ej.js`...

a Creates an HTTP server at port 8000

b Creates a TCP server at port 8000

c Creates a TCP server at the port number stored in A1

d Creates a TCP server at the port number stored in A2

3 *In* `ej.js,` *variable sg is used to …*

a count the number of clients successfuly connected

b count the number of served requests

c determine how the next message is to be processed

d determine if the proxy has already opened a conection to the target TCP server

4 *In* `ej.js,` *variable c is used to count the number of …*

a messages sent by the client

b clients that have provided correct *session* start information (user, password)

c connected clients

d clients that have been accepted after their initial message

5 *In* `ej.js,` *a client sends an initial JSON-formatted message …*

a that must include the user name and password

b with the following information: username and password, plus ip address and port number where the request must be forwarded

c `login`, so that it sends next the *session* start information: `usuario, clave`

d `op:login`

6 *In* `ej.js,` *function procesa can access variable sg because …*

a *sg* is a global variable

b *sg* is an attribute of the global object

c *procesa* is defined when running the anonymous function defined on line 7, and that function declares *sg* within its scope

d *sg* is passed as a parameter

7 *Considering the code of* `ej.js,` *select the correct answer:*

a Kat most one client can access the functionality of the proxy

b The following situation is possible: no client has started a session with the proxy, and no client can start a sessions with the proxy

c Only even clients can start a session

d Only odd clients can start a session

8 *Consider changing line 8 in file* `ej.js` *like this*

sg = 0; *var s, ssC = false*

a The resulting code is functionally equivalent to the originally provided

b Clients can no longer start a session with the proxy

c At most one client can connect to the proxy

d At most one client can start a session with the proxy

9 *Let us change the lines from* `ej.js` *specified within parenthesis as follows*

(8) *var s*, *ssC* = *false*
(13) *var sg* = 0;

- **a** The resulting code is functionally equivalent to the originally provided
- **b** Only client `mc` can start a session with the proxy
- **c** No client can start a session with the proxy
- **d** Only the first arriving client can start a session with the proxy

10 *Let us change the lines from* `ej.js` *specified within parenthesis as follows*

(3) *var sg* = {}, *c* = 0
(8) *sg*[*soc*] = 0; *var s*, *ssC* = *false*
(15) **switch** (*sg*[*soc*])
(17) **if** (*obj.op*=="*login*"){*w*("*OK*");*sg*[*soc*]++}
(23) () => {*sg*[*soc*]++;*w*("*login ok*");})

- **a** The resulting code is functionally equivalent to the originally provided
- **b** The stage counter, *sg*, is shared among all clients. As a consequence, no client can start a session
- **c** No client goes beyond stage 1
- **d** Only the first client can go beyond stage 1

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A

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7	7	7	7	7	7	7	7
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ETSINF - Tsr

First Parcial + Lab 1 - 11/07/2018

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Name ....

Mark this way

DO NOT mark this way

DO NOT ERASE, do corrections with Typex

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Lab

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