UNIVERSITY OF BRISTOL

Summer Examination Period

FACULTY OF ENGINEERING

2023 Examination for the Degree of
Bachelor and Master of Engineering and Bachelor and Master of Science

COMS10012
Software Tools

TIME ALLOWED:
2 Hours

Answers to COMS10012: Software Tools

Intended Learning Outcomes:

1. Please make sure you read the instructions on the answer sheet.

2. Each question is worth 1 mark.

3. Only the answer sheet will be marked, the empty pages at the back of the exam are only used for your calculations.

4. When selecting answers, make clear, horizontal marks within the two sets of brackets, making sure that the contained letter is struck through.

5. Avoid marking the answer sheet outside specified areas.

6. Do not crease, dog-ear or otherwise damage the answer sheet.

Q1. Alice wishes to merge the branch `hotfix` into the branch `testing`. Which commands should they run?

      A. `git checkout testing; git merge hotfix`

      B. `git checkout hotfix; git merge testing`

      C. `git checkout testing; git rebase hotfix`

      D. `git checkout hotfix; git merge testing --no-ff`

[1 mark]

Q2. Which option most accurately describes what the `git clone` command does?

      A. `git clone` extracts a version of a file under version control at a specific commit point in history.

      B. `git clone` makes a local copy of an entire repository

      C. `git clone` fetches a file from Github and downloads it locally

      D. `git clone` duplicates a repository on a remote Git forge (like Github)

[1 mark]

Q3. When trying to fetch from a git remote Alice encounters the following error:

```
$ git fetch
ssh: Could not resolve hostname github.com: no address associated with name
fatal: Could not read from remote repository.

Please make sure you have the correct access rights
and the repository exists.
```

What is the issue?

      A. Their public key has not been correctly set up on Github.

      B. The repository doesn't exist; they need to create it before they can pull;

      C. There is a merge conflict

      D. Their network is down or misconfigured.

[1 mark]

Q4. Alice wants to delete the last commit they made on the `main` branch. What command or commands do they need to use?

      A. `git checkout main~1`

      B. `git clean`

      C. `git checkout main; git reset main~1`

      D. `git branch -D main`

[1 mark]

Q5. When running a command into their favourite pager more (so they can scroll it on the terminal) Alice notices the following unusual output. What is going on, and what are the weird ESC[01;34m bits?

```
$ ls --color=always | more
ESC[0mESC[01;34mBackupsESC[0m
ESC[01;34mDesktopESC[0m
ESC[01;34mDocumentsESC[0m
ESC[01;36mDownloadsESC[0m
ESC[01;34mMailESC[0m
ESC[01;34mMusicESC[0m
ESC[01;36mNotesESC[0m
ESC[01;34mPicturesESC[0m
ESC[01;34mReposESC[0m
ESC[01;34mVideosESC[0m
mbox
- (END)
```

    A. They are part of the filenames

    B. They are ANSI color escape codes. The pager more doesn't know to translate them into colors

    C. The terminal has glitched and is displaying random noise

    D. They are escape codes embedded as part of the filenames to make some filenames italic

[1 mark]

Q6. Bob has the following id:

```
$ id
uid=1000(bob) gid=800(users) groups=800(users)
```

The passwd program has the following permissions:

```
$ ls -l `command -v passwd`
-r-sr-sr-x 1 root bin 21112 Feb 12 00:27 /usr/bin/passwd
```

What user and group will it run as?

    A. uid=root, gid=bin

    B. uid=root, gid=users

    C. uid=bob, gid=users

    D. uid=bob, gid=bin

[1 mark]

Q7. What is an *inode*?

    A. An inode is an Apple music playing device

    B. An inode is the underlying datastructure used to store files on a disk

    C. An inode is a system call used to access files on a filesystem

    D. In ODE means that the solution to this problem can be expressed as a series of ordinary differential equations

[1 mark]

Q8. What flag is needed to make the `ls` command list inode numbers?

    A. `-i`

    B. `-l`

    C. `-n`

    D. `-z`

[1 mark]

Q9. Alice has the following Makefile. Since the last build, they have made some updates to `main.c`. Which rules will be run when next typing `make`?

```
main: main.c interface.o analysis.o

docs.html: main.c interface.c analysis.c library.c
        documentation-generator main.c interface.c analysis.c library.c -o $@

interface.o: interface.c config.c
analysis.o: analysis.c library.o
library.o: library.c
```

    A. main

    B. main interface.o analysis.o

    C. main docs.html

    D. main interface.o analysis.o docs.html

[1 mark]

Q10. Alice has created a new program in Java using the Maven buildsystem.

Their `pom.xml` file looks like the following:

```xml
<?xml version="1.0" encoding="UTF-8"?>
<project xmlns="http://maven.apache.org/POM/4.0.0"
    xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xsi:schemaLocation="http://maven.apache.org/POM/4.0.0
      http://maven.apache.org/xsd/maven-4.0.0.xsd">
  <modelVersion>4.0.0</modelVersion>

  <groupId>com.mycompany.app</groupId>
  <artifactId>my-app</artifactId>
  <version>1.0-SNAPSHOT</version>

  <name>my-app</name>
  <url>http://www.example.com</url>

  <properties>
    <project.build.sourceEncoding>UTF-8</project.build.sourceEncoding>
    <maven.compiler.source>1.7</maven.compiler.source>
    <maven.compiler.target>1.7</maven.compiler.target>
  </properties>

  <build>
    <pluginManagement><!-- lock down plugins versions to avoid using Maven defaults
        (may be moved to parent pom) -->
      <plugins>
        <!-- clean lifecycle, see
            https://maven.apache.org/ref/current/maven-core/lifecycles.html#clean_Lifecycle
            -->
        <plugin>
          <artifactId>maven-clean-plugin</artifactId>
          <version>3.1.0</version>
        </plugin>
        <!-- default lifecycle, jar packaging: see
            https://maven.apache.org/ref/current/maven-core/default-bindings.html#Plugin_bindings_for
            -->
        <plugin>
          <artifactId>maven-resources-plugin</artifactId>
          <version>3.0.2</version>
        </plugin>
        <plugin>
          <artifactId>maven-compiler-plugin</artifactId>
          <version>3.8.0</version>
        </plugin>
        <plugin>
          <artifactId>maven-surefire-plugin</artifactId>
          <version>2.22.1</version>
        </plugin>
        <plugin>
          <artifactId>maven-jar-plugin</artifactId>
```

Qu. continues ...

```
        <version>3.0.2</version>
      </plugin>
      <plugin>
        <artifactId>maven-install-plugin</artifactId>
        <version>2.5.2</version>
      </plugin>
      <plugin>
        <artifactId>maven-deploy-plugin</artifactId>
        <version>2.8.2</version>
      </plugin>
      <!-- site lifecycle, see
          https://maven.apache.org/ref/current/maven-core/lifecycles.html#site_Lifecycle
          -->
      <plugin>
        <artifactId>maven-site-plugin</artifactId>
        <version>3.7.1</version>
      </plugin>
      <plugin>
        <artifactId>maven-project-info-reports-plugin</artifactId>
        <version>3.0.0</version>
      </plugin>
    </plugins>
  </pluginManagement>
 </build>
</project>
```

When Alice builds their project and run the tests Maven throws the following error:

```
$ mvn test
[INFO] Scanning for projects...
[INFO]
[INFO] ---------------------< com.mycompany.app:my-app >----------------------
[INFO] Building my-app 1.0-SNAPSHOT
[INFO] ------------------------------[ jar ]-------------------------------
[INFO]
[INFO] --- maven-resources-plugin:3.0.2:resources (default-resources) @ my-app ---
[INFO] Using 'UTF-8' encoding to copy filtered resources.
[INFO] skip non existing resourceDirectory /tmp/test/my-app/my-app/src/main/resources
[INFO]
[INFO] --- maven-compiler-plugin:3.8.0:compile (default-compile) @ my-app ---
[INFO] Nothing to compile - all classes are up to date
[INFO]
[INFO] --- maven-resources-plugin:3.0.2:testResources (default-testResources) @
   my-app ---
[INFO] Using 'UTF-8' encoding to copy filtered resources.
[INFO] skip non existing resourceDirectory /tmp/test/my-app/my-app/src/test/resources
[INFO]
[INFO] --- maven-compiler-plugin:3.8.0:testCompile (default-testCompile) @ my-app ---
[INFO] Changes detected - recompiling the module!
[INFO] Compiling 1 source file to /tmp/test/my-app/my-app/target/test-classes
[INFO] -----------------------------------------------------------
```

(cont.)

```
[ERROR] COMPILATION ERROR :
[INFO] -------------------------------------------------------------
[ERROR] /tmp/test/my-app/my-app/src/test/java/com/mycompany/app/AppTest.java:[3,24]
    package org.junit does not exist
[ERROR] /tmp/test/my-app/my-app/src/test/java/com/mycompany/app/AppTest.java:[3,1]
    static import only from classes and interfaces
[ERROR] /tmp/test/my-app/my-app/src/test/java/com/mycompany/app/AppTest.java:[5,17]
    package org.junit does not exist
[ERROR] /tmp/test/my-app/my-app/src/test/java/com/mycompany/app/AppTest.java:[15,6]
    cannot find symbol
  symbol:  class Test
  location: class com.mycompany.app.AppTest
[ERROR] /tmp/test/my-app/my-app/src/test/java/com/mycompany/app/AppTest.java:[18,9]
    cannot find symbol
  symbol:  method assertTrue(boolean)
  location: class com.mycompany.app.AppTest
[INFO] 5 errors
[INFO] -------------------------------------------------------------
[INFO] ------------------------------------------------------------------------
[INFO] BUILD FAILURE
[INFO] ------------------------------------------------------------------------
[INFO] Total time: 0.917 s
[INFO] Finished at: 2023-02-14T15:42:26Z
[INFO] ------------------------------------------------------------------------
[ERROR] Failed to execute goal
    org.apache.maven.plugins:maven-compiler-plugin:3.8.0:testCompile
    (default-testCompile) on project my-app: Compilation failure: Compilation
    failure:
[ERROR] /tmp/test/my-app/my-app/src/test/java/com/mycompany/app/AppTest.java:[3,24]
    package org.junit does not exist
[ERROR] /tmp/test/my-app/my-app/src/test/java/com/mycompany/app/AppTest.java:[3,1]
    static import only from classes and interfaces
[ERROR] /tmp/test/my-app/my-app/src/test/java/com/mycompany/app/AppTest.java:[5,17]
    package org.junit does not exist
[ERROR] /tmp/test/my-app/my-app/src/test/java/com/mycompany/app/AppTest.java:[15,6]
    cannot find symbol
[ERROR]  symbol:  class Test
[ERROR]  location: class com.mycompany.app.AppTest
[ERROR] /tmp/test/my-app/my-app/src/test/java/com/mycompany/app/AppTest.java:[18,9]
    cannot find symbol
[ERROR]  symbol:  method assertTrue(boolean)
[ERROR]  location: class com.mycompany.app.AppTest
[ERROR] -> [Help 1]
[ERROR]
[ERROR] To see the full stack trace of the errors, re-run Maven with the -e switch.
[ERROR] Re-run Maven using the -X switch to enable full debug logging.
[ERROR]
[ERROR] For more information about the errors and possible solutions, please read
    the following articles:
[ERROR] [Help 1]
```

Qu. continues ...

`http://cwiki.apache.org/confluence/display/MAVEN/MojoFailureException`

What has gone wrong?

    A. The Java compiler version is incorrect

    B. The `pom.xml` is syntactically incorrect

    C. The syntax of the `mvn` comand is wrong

    D. A dependency is missing

[1 mark]

Q11. Bob wants to store a table containing students answers in an SQL database. The table should have 3 attributes:

- `student` (an 8 digit number which references the `id` attribute of the `student` table)
- `question` (a 2 digit number which references the `id` attribute of the `question` table)
- `answer` (text containing their answer)

What SQL command would create the most appropriate table?

    A. `CREATE TABLE answers(student VARCHAR(8), question INTEGER, answer TEXT, FOREIGN KEY student REFERENCES student(id), FOREIGN KEY question REFERENCES question(id), PRIMARY KEY (answer));`

    B. `CREATE TABLE answers(student VARCHAR(8), question INTEGER, answer TEXT UNIQUE, FOREIGN KEY student REFERENCES student(id), FOREIGN KEY question REFERENCES question(id), PRIMARY KEY (student, question));`

    C. `INSERT INTO answers(student, question, answer) VALUES ("0607970", 10, "C");`

    D. `CREATE TABLE answers(student VARCHAR(8), question INTEGER, answer TEXT, FOREIGN KEY student REFERENCES student(id), FOREIGN KEY question REFERENCES question(id), PRIMARY KEY (student, question));`

[1 mark]

Q12. Bob wants to find each students mark in the exam. If each question is worth 1 mark, which SQL query will find the students' total scores?

You can assume the following tables in Bob's database:

Exam:

Student	Question	Answer
1	1	A
1	2	B
2	1	A
2	2	C
3	1	-
3	2	-

Answers:

Question	Answer
1	A
2	B

A. `SELECT student, COUNT(exam.answer = answers.answer) AS mark FROM exam JOIN answers WHERE exam.question=answers.question GROUP BY student_id;`

B. `SELECT student, SUM(exam.answer = answers.answer) AS mark FROM exam JOIN answers WHERE exam.question=answers.question GROUP BY student_id;`

C. `SELECT student, SUM(exam.answer = answers.answer) AS mark FROM exam JOIN answers WHERE exam.question=answers.question GROUP BY exam.question;`

D. `SELECT student, COUNT(exam.answer = answers.answer) AS mark FROM exam JOIN answers WHERE exam.question=answers.question GROUP BY exam.question;`

[1 mark]

Q13. The `FOREIGN KEY` constraint implies which other constraints (if any)?

A. `NOT NULL, UNIQUE`

B. `NOT NULL`

C. `UNIQUE`

D. No other constraints

[1 mark]

Q14. Bob is trying to run a command but it isn't working. To debug their issue they run their command with `strace`. What command are they trying to run?

```
execve("/usr/bin/cd", ["cd", "/home/jhl8636"], 0x7fff0476de18 /* 28 vars */) = 0
brk(NULL)                               = 0x1020000
access("/etc/ld.so.preload", R_OK)      = -1 ENOENT (No such file or directory)
open("/etc/ld.so.cache", O_RDONLY|O_CLOEXEC) = 3
fstat(3, {st_mode=S_IFREG|0644, st_size=43207, ...}) = 0
close(3)                                = 0
open("/lib64/libtinfo.so.5", O_RDONLY|O_CLOEXEC) = 3
read(3, "\177ELF\2\1\1\0\0\0\0\0\0\0\0\0\3\0>\0\1\0\0\0@\316\0\0\0\0\0\0"..., 832) =
    832
fstat(3, {st_mode=S_IFREG|0755, st_size=174576, ...}) = 0
close(3)                                = 0
open("/lib64/libdl.so.2", O_RDONLY|O_CLOEXEC) = 3
read(3, "\177ELF\2\1\1\0\0\0\0\0\0\0\0\0\3\0>\0\1\0\0\0P\16\0\0\0\0\0\0"..., 832) =
    832
fstat(3, {st_mode=S_IFREG|0755, st_size=19248, ...}) = 0
close(3)                                = 0
open("/lib64/libc.so.6", O_RDONLY|O_CLOEXEC) = 3
read(3, "\177ELF\2\1\1\3\0\0\0\0\0\0\0\0\0\3\0>\0\1\0\0\0`&\2\0\0\0\0\0"..., 832) = 832
fstat(3, {st_mode=S_IFREG|0755, st_size=2156592, ...}) = 0
close(3)                                = 0
arch_prctl(ARCH_SET_FS, 0x7f96437f7740) = 0
access("/etc/sysconfig/strcasecmp-nonascii", F_OK) = -1 ENOENT (No such file or
    directory)
access("/etc/sysconfig/strcasecmp-nonascii", F_OK) = -1 ENOENT (No such file or
    directory)
munmap(0x7f96437fa000, 43207)           = 0
open("/dev/tty", O_RDWR|O_NONBLOCK) = 3
close(3)                                = 0
brk(NULL)                               = 0x1020000
brk(0x1041000)                          = 0x1041000
brk(NULL)                               = 0x1041000
open("/usr/lib/locale/locale-archive", O_RDONLY|O_CLOEXEC) = 3
fstat(3, {st_mode=S_IFREG|0644, st_size=106176928, ...}) = 0
close(3)                                = 0
brk(NULL)                               = 0x1041000
getuid()                                = 377810
getgid()                                = 1349
geteuid()                               = 377810
getegid()                               = 1349
open("/proc/meminfo", O_RDONLY|O_CLOEXEC) = 3
fstat(3, {st_mode=S_IFREG|0444, st_size=0, ...}) = 0
read(3, "MemTotal:     3868352 kB\nMemF"..., 1024) = 1024
close(3)                                = 0
munmap(0x7f9643804000, 4096)            = 0
uname({sysname="Linux", nodename="seis-shell", ...}) = 0
stat("/home/jh18636", {st_mode=S_IFDIR|0700, st_size=512, ...}) = 0
stat(".", {st_mode=S_IFDIR|0700, st_size=512, ...}) = 0
getpid()                                = 48130
```

(cont.)

```
open("/usr/lib64/gconv/gconv-modules.cache", O_RDONLY) = 3
fstat(3, {st_mode=S_IFREG|0644, st_size=26970, ...}) = 0
close(3)                                = 0
getppid()                               = 48128
getpgrp()                               = 48128
getrlimit(RLIMIT_NPROC, {rlim_cur=4*1024, rlim_max=14900}) = 0
open("/usr/bin/cd", O_RDONLY)           = 3
ioctl(3, TCGETS, 0x7ffef00471e0)        = -1 ENOTTY (Inappropriate ioctl for device)
lseek(3, 0, SEEK_CUR)                   = 0
read(3, "#!/bin/sh\nbuiltin cd \"$@\"\n", 80) = 26
lseek(3, 0, SEEK_SET)                   = 0
getrlimit(RLIMIT_NOFILE, {rlim_cur=1024, rlim_max=4*1024}) = 0
fcntl(255, F_GETFD)                     = -1 EBADF (Bad file descriptor)
dup2(3, 255)                            = 255
close(3)                                = 0
fcntl(255, F_SETFD, FD_CLOEXEC)         = 0
fcntl(255, F_GETFL)                     = 0x8000 (flags O_RDONLY|O_LARGEFILE)
fstat(255, {st_mode=S_IFREG|0755, st_size=26, ...}) = 0
lseek(255, 0, SEEK_CUR)                 = 0
read(255, "#!/bin/sh\nbuiltin cd \"$@\"\n", 26) = 26
stat("/home", {st_mode=S_IFDIR|0755, st_size=2097152, ...}) = 0
stat("/home/jhl8636", 0x7ffef0046e80) = -1 ENOENT (No such file or directory)
open("/usr/share/locale/locale.alias", O_RDONLY|O_CLOEXEC) = 3
fstat(3, {st_mode=S_IFREG|0644, st_size=2502, ...}) = 0
read(3, "# Locale name alias data base.\n#"..., 4096) = 2502
read(3, "", 4096)                       = 0
close(3)                                = 0
munmap(0x7f96437fd000, 4096)            = 0
open("/usr/share/locale/en_GB.UTF-8/LC_MESSAGES/libc.mo", O_RDONLY) = -1 ENOENT (No
    such file or directory)
open("/usr/share/locale/en_GB.utf8/LC_MESSAGES/libc.mo", O_RDONLY) = -1 ENOENT (No
    such file or directory)
open("/usr/share/locale/en_GB/LC_MESSAGES/libc.mo", O_RDONLY) = 3
fstat(3, {st_mode=S_IFREG|0644, st_size=1474, ...}) = 0
close(3)                                = 0
open("/usr/share/locale/en.UTF-8/LC_MESSAGES/libc.mo", O_RDONLY) = -1 ENOENT (No
    such file or directory)
open("/usr/share/locale/en.utf8/LC_MESSAGES/libc.mo", O_RDONLY) = -1 ENOENT (No such
    file or directory)
open("/usr/share/locale/en/LC_MESSAGES/libc.mo", O_RDONLY) = -1 ENOENT (No such file
    or directory)
fstat(2, {st_mode=S_IFCHR|0620, st_rdev=makedev(136, 8), ...}) = 0
open("/usr/share/locale/en_GB.UTF-8/LC_MESSAGES/bash.mo", O_RDONLY) = -1 ENOENT (No
    such file or directory)
open("/usr/share/locale/en_GB.utf8/LC_MESSAGES/bash.mo", O_RDONLY) = -1 ENOENT (No
    such file or directory)
open("/usr/share/locale/en_GB/LC_MESSAGES/bash.mo", O_RDONLY) = -1 ENOENT (No such
    file or directory)
open("/usr/share/locale/en.UTF-8/LC_MESSAGES/bash.mo", O_RDONLY) = -1 ENOENT (No
    such file or directory)
```

Qu. continues …

```
open("/usr/share/locale/en.utf8/LC_MESSAGES/bash.mo", O_RDONLY) = -1 ENOENT (No such
    file or directory)
open("/usr/share/locale/en/LC_MESSAGES/bash.mo", O_RDONLY) = -1 ENOENT (No such file
    or directory)
write(2, "/usr/bin/cd: line 2: cd: /home/j"..., 66/usr/bin/cd: line 2: cd:
    /home/jhl8636: No such file or directory
) = 66
read(255, "", 26)                 = 0
exit_group(1)                     = ?
+++ exited with 1 +++
```

> A. `bash`
>
> **B. `cd`**
>
> C. `execve`
>
> D. `/etc/ld.so.preload`

[1 mark]

Q15. Bob is trying to run a command but it still isn't working. Using the trace from before: what type of program does `strace` try and run, in the first instance?

> A. A compiled binary command
>
> **B. A shell script**
>
> C. A shell builtin command
>
> D. Impossible to say

[1 mark]

Q16. Bob is trying to run a command but it still isn't working. Using the trace from before: what's the problem?

> A. The command they've tried to run doesn't exist
>
> B. The permissions are set to prevent their command running
>
> C. The filesystem and it's inodes are corrupt.
>
> **D. A folder they've tried to access doesn't exist**

[1 mark]

Q17. Which of the following bash scripts would produce the output string "the easiest question"?

A.
```
#!/bin/bash
input="the hardest question"
echo input | sed s/easiest/hardest/
```

B.
```
#!/bin/bash
input="the hardest question"
echo $input | sed s/hard/easi/
```

C.
```
#!/bin/bash
input=the hardest question
echo "$input | sed s/hardest/easiest/"
```

D.
```
!#/bin/bash
input="the hardest question"
echo "input | sed s/easi/hard/"
```

> **Solution:** There are clear mistakes in every other answer. A echoes 'input' rather than '$input' and gets the order of the sed s-expr components wrong. C assigns the string without quotemarks and echoes a string containing the sed command rather than piping input to that command. D also makes this mistake, gets the sed order wrong, and gets the shebang syntax wrong.

[1 mark]

Q18. Alice is trying to set up key-based login on a service she currently accesses via using ssh and entering her password. Here are listings of her .ssh directory on her local machine:

```
-rw------- 1 alice alice 389 Jan 19 10:56 authorized_keys
-rw-r--r-- 1 alice alice 395 Feb 21 13:03 id_rsa.pub
-rw-r--r-- 1 alice alice 225 Feb 21 13:01 known_hosts
```

And on the server:

```
-r-------- 1 alice alice 395 Feb 21 13:30 authorized_keys
-rw-r--r-- 1 alice alice 395 Feb 21 13:21 id_rsa.pub
-rw-r--r-- 1 alice alice 225 Jan 19 11:02 known_hosts
```

There's a problem evident with her current setup. Identify which file's presence, absence or visible details indicates the problem.

A. The problem lies with 'authorized_keys' on the local machine.

B. The problem lies with 'known_hosts' on the server.

C. The problem lies with 'id_rsa' on the local machine.

D. The problem lies with 'id_rsa.pub' on the server.

Solution: The absence of a private key on the local machine is a clear problem for key-based login. The permissions on the files are all correct. Moreover, 'authorized_keys' serves no purpose locally, and 'known_hosts' and 'id_rsa.pub' don't matter on the server. We went through this key-based setup process in the SSH labs at the start of Part 1.

[1 mark]

Q19. Which of the below would redirect both standard output and standard error from `myprogram` to `log.txt`?

     A. `./myprogram > log.txt 1> log.txt`

     B. `./myprogram 1> log.txt 2>&1`

     C. `./myprogram 2>&1 > log.txt`

     D. `./myprogram 2&1> log.txt`

Solution: A doesn't redirect stderr, C has the right idea but sends stderr to stdout before redirecting stdout (we covered exactly this issue in the lecture), D looks sort of plausible but simply isn't valid.

[1 mark]

Q20. If `command2` ignores standard input and will only work with a file passed as an argument, how can we redirect the output of `command1` to be used by `command2`?

     A. `command1 > command2`

     B. `command2 $(command1)`

     C. `command1 | command2`

     D. `command2 <(command1)`

Solution: Note that we specified that command2 ignores standard input, so C would not work. B uses the output as an argument, which is not what command2 would understand, and A would just write command1 output to a file called command2.

[1 mark]

Q21. Look at the below shell session:

```
$ cp * ~/backup/
cp: cannot stat '*': No such file or directory
```

What can be said about the state of the filesystem and shell environment?

     A. There is no file called '*' in the current working directory.

     B. There is no file called 'cp' in the current working directory.

     C. The current working directory is empty.

     D. All of the above.

Solution: C implies A and B. We showed and explained this error message in one of the first shell lectures.

[1 mark]

Q22. Consider the following HTTP request as received by a web server:

```
GET /about.html HTTP/1.1
Host: www.example.com
User-Agent: Mozilla/5.0 (X11; Linux x86_64; rv:108.0) Firefox/108.0
Accept: text/html,application/xhtml+xml,application/xml
Accept-Language: en-GB,en;q=0.5
Accept-Encoding: gzip, deflate, br
Connection: keep-alive
```

Assuming the request headers can be trusted, which of the following best describes what has happened to cause this request?

  A. Someone attempted to run gzip on the webpage `about.html` from their Linux terminal.

  B. Someone running the X11 windowing system navigated to `http://www.example.com/about.html`.

  C. Someone running the Mozilla OS navigated to `www.example.com`.

  D. Several browsers made the same request for `about.html` at once, forcing the server to keep the connection alive.

Solution: A & D are nonsense, C involves a misreading of the user-agent and ignoring the path component of the GET request. The first lab involved studying these requests.

[1 mark]

Q23. You encounter an unfamiliar HTTP status code 413. Without knowing more than this code, which of the below might you reasonably conclude?

  A. The request has completed successfully, with some additional effects.

  B. The server needs to redirect you to another location.

  C. The server has encountered an internal error.

  D. There is an error in the request sent by the client.

Solution: We covered HTTP status codes and the first-digit meanings in the HTTP lecture (slide 11).

[1 mark]

Q24. Consider this snippet of HTML:

```
<p>
  I'm creating a link to
  <a
    href="https://www.mozilla.org/en-US/"
    title="The best place to find more information about Mozilla's
           mission and how to contribute">the Mozilla homepage</a>.
</p>
```

Which of the below reflects the text you would click on in the browser to follow the link?

  A. "I'm creating a link to the Mozilla homepage."

  B. "the Mozilla homepage"

  C. "https://www.mozilla.org/en-US/"

  D. "The best place to find more information about Mozilla's mission and how to contribute"

> **Solution:** This example comes from the required MDN reading, and answering it only requires understanding how anchor tags work, which is explained in the HTML5 lecture.

[1 mark]

Q25. Which of the following HTML elements should contain `<meta>` elements?

  A. `<header>`

  B. `<head>`

  C. `<nav>`

  D. None of the above.

> **Solution:** We covered the fact that metadata goes in the `<head>` in the first HTML lecture. This should also have become apparent in several of the labs.

[1 mark]

Q26. Which of these CSS selectors will apply a style to one `<p>` element immediately following an `<img>` element with the class attribute 'insert'?

  A. `img#insert p`

  B. `img.insert > p`

  C. `img#insert ~ p`

  D. `img.insert + p`

[1 mark]

Q27. A style with the selector of `.aside, h2, h3` would be applied to:

    A. All elements with the class 'aside', and all second- and third- level headings.

    B. The element with the ID 'aside', and all second- and third- level headings.

    C. Any third-level headings subordinate to a second-level heading inside an element with the ID 'aside'.

    D. Any third-level headings or second-level headings inside an element with the class 'aside'.

[1 mark]

Q28. When representing a colour in CSS, the keyword 'green' is equivalent to

    A. `#FF0000`

    B. `#00F000`

    C. `#00F00F`

    D. `#00FF00`

[1 mark]

Q29. You have been tweaking the style of an `<img>` element so that it has a visible border. You want to create some visual space between the border and other elements on the page, with twice as much space below as there is above. Which of these rules should you use?

    A. `padding: 10px 5px 20px 5px;`

    B. `margin: 8px 8px 16px 8px;`

    C. `padding: 16px 8px 16px 8px;`

    D. `margin: 5px 5px 5px 10px;`

[1 mark]

Q30. Consider the following stylesheet:

```
html { font-size: 14px; }
p {font-size: 0.8em; }
div {font-size: 1.2em; }
```

Imagine this stylesheet is applied to a page which contains a `<p>` element inside a `<div>` element. What would be the size of the text in the `<p>` element, as measured in `px`?

    A. 14

    B. 12

    C. 16.80

    D. 13.44

[1 mark]

Q31. Consider the following CSS rules:

```css
.container {
 display: grid;
 gap: 20px;
}
.listitem {
 grid-area: 1 / 2 / 3 / 4;
}
```

Assuming an element corresponding to the second selector is placed in the grid container, on which row will the element end?

      A. 1

      B. 2

      C. 3

      D. 4

> **Solution:** The 1/3 relate to the row start and end respectively. The grid-area, including interpreting this way of defining element bounds, was discussed in the second CSS session's lecture on the CSS grid.

[1 mark]

Q32. Karen is using `wget` to download a website `example.com`. The index page of `example.com` contains the following HTML:

```html
<!DOCTYPE html>
<html>
<head>
        <meta charset="UTF-8">
        <link type="text/css" href="style.css" rel="stylesheet">
        <title>Example Page</title>
</head>
<body>
<h1>Example Page</h1>
<p>See the <a href="./about.html">about</a> page for more about this
site, or check out the <a href="https://www.iana.org/domains/example">
IANA resources</a> for more about example pages.</p>

</body>
</html>
```

If she downloads the page by invoking

  `wget -r -l 1 http://example.com`

How many files will be retrieved in total?

A. 1

B. 2

C. 3

D. 4

> **Solution:** The index page, the about.html page and the style.css from the header will be retrieved. -l 1 means no further recursion will proceed on linked pages, and wget will not follow the link to the external domain. Controlling wget recursion is part of the first set of web scraping exercises.

[1 mark]

Q33. Cloud computing involves:

A. Moving data to near-edge devices such as routers.

B. The on-demand availability of resources such as storage and computational power.

C. A distributed architecture making use of a shared hash table to achieve consensus.

D. All of the above.

> **Solution:** A is fog computing, C is a hazy description of the blockchain. Cloud computing was introduced in the Cloud lecture.

[1 mark]

Q34. Which of the following statements are true?

1. JavaScript is a interpreted language

2. Javascript is a compiled language

A. Both are correct

B. Only 2 is correct

C. Both are wrong

D. Only 1 is correct

[1 mark]

Q35. Which of the following are syntactically correct ways to include Java Script code in your HTML?

```
1 <script src="file.js"></script>
2 <script> code </script>
```

(cont.)

A. Both are correct.

B. 1 is correct

C. 2 is correct

D. Both are wrong

[1 mark]

Q36. What will be the output of `console.log(a);`?

```
console.log(a);
var a = 10;
```

A. Reference error

B. Undefined

C. 10

D. a

Q37. What will be the output of `console.log(a);` in each of the cases?

1
```
function hello(b){
   console.log(a);
}
var a = "John";
hello();
```

2
```
function hello(b){
 console.log(a);
     function Name(c){
     var a = "John";
     }

}
hello();
```

A. John & John

B. John & Undefined

C. Undefined & John

D. John & Reference Error

Q38. What will be the output of `console.log();` below?

```
const obj1 = {Name: "John", Age: 20};
const obj2 = {Name: "John", Age: 20};

console.log(obj1===obj2);
```

    A. True

    B. Undefined

    C. False

    D. None of the above

[1 mark]

Q39. Will the following function work?

```
mult = () => {return(10*5);}
```

    A. Yes

    B. An exception will be thrown

    C. It will leak memory

    D. It will produce an error

[1 mark]

Q40. What will be the output of the following code?

```
const data = {
"name": "John",
"hobby": "Swimming",
"language" : ["English", "German", "French"]
 }
 console.log(data.language[0]);
```

    A. John

    B. Swimming

    C. English

    D. Prints empty array

[1 mark]

Q41. What will be the output of the following code?

```
function printArray(a){
    var len = a.length, i=a.length-1;
    if (len==0)
        console.log("Empty Array");
    else
        {
          do
            {
                console.log(a[i]);
                i--;
            }while(i>=0);
        }
    }
   b = [1,2,3,4,5];
   printArray(b);
```

A. 1,2,3,4,5

B. Prints 0 to length of the array

C. **5,4,3,2,1**

D. Prints empty array

[1 mark]

Q42. How would you refer to the parent class in REACT?

    A. this()

    B. inherits()

    C. self()

    D. super()

<div align="right">

[1 mark]

</div>

Q43. What will this code do?

```
const root = ReactDOM.createRoot(document.getElementById(`root'));
root.render(
    <React.StrictMode>
    Do something.....
    </React.StrictMode>
 )
```

    A. Nothing

    B. Do something in the element with the ID.

    C. Only get an element by the ID.

    D. None of the above.

<div align="right">

[1 mark]

</div>

Q44. What happens when you put this in a render() method?

```
let names = ["John","Matt","Joseph"];
function App() {
  return (
<div className="App">
{names.map(it => <p>{it}</p>)}
 </div>)
}
```

    A. Displays Nothing

    B.   **John**

                          Matt

                          Joseph

    C. Error

    D. None of the above.

<div align="right">

[1 mark]

</div>

<div align="right">

Qu. continues ...

</div>

—Blank page—

(cont.)

—Blank page—

Qu. continues ...

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