UNIVERSITY OF BRISTOL

Summer Examination Period

FACULTY OF ENGINEERING

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

COMS10012/COMSM0085
Software Tools

TIME ALLOWED:
1 Hour

This paper contains 16 questions, all of which are used for assessment; the maximum for this paper is 16.

Other Instructions:

This exam is open-book: you may bring in any handwritten or printed materials. You may use a faculty-approved calculator model.

TURN OVER ONLY WHEN TOLD TO START WRITING

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. 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]

Q3. 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]

Q4. 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]

Q5. Alice has created a new program in Java using the Maven buildsystem.

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

```
 <?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_fo
           -->
       <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>
```

(cont.)

```
          <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] -------------------------------------------------------------
```

```
[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]
```

(cont.)

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]

Q6. 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]

Q7. Bob wants to find each student's 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]

Q8. 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/jh18636"], 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
```

Qu. continues . . .

```
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)
```

(cont.)

```
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]

Q9. 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/"
```

[1 mark]

Q10. 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
```

        Qu. continues . . .

There's a problem evident with her current setup. Identify which file's presence, abscence 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.

[1 mark]

Q11. Imran is trying to create a copy of a file `commented.c` with all lines that begin with '//' in the original removed from the copy. Which of the below commands would produce this effect?

    A. `grep -v ^// commented.c > uncommented.c`

    B. `grep -i // commented.c > uncommented.c`

    C. `grep -v //$ commented.c > uncommented.c`

    D. `grep -i //$ commented c > uncommented.c`

[1 mark]

Q12. 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`

[1 mark]

Q13. What would be the output when executing the following piped command?

`echo "text␣in␣here" | sed 's/in//' | wc -w`

    A. "text here"

    B. 3

    C. 2

    D. None of the above.

[1 mark]

Q14. The Unix philosophy suggests that:

    A. Each program should do one thing well.

    B. Programs do not need to be able to cooperate.

(cont.)

      C. The universal interface between programs should be a video stream.

      D. All of the above.

<div align="right">[1 mark]</div>

Q15. 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)`

<div align="right">[1 mark]</div>

Q16. 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.

<div align="right">[1 mark]</div>

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Qu. continues . . .

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