Do not turn this page until you have received the signal to start.
(In the meantime, please fill out the identification section above, and read the instructions below carefully.)
Question 1.  [5 MARKS]

Circle the correct answer.

TRUE    FALSE
When a pipe is used in shell such as ls | wc, the second process
does not start until the first has completed.

TRUE    FALSE
The following are all examples of expressions that evaluate to abso-
lute paths: /bin, $HOME/bin, ~/a/b.

TRUE    FALSE
I need to compile my shell program before I can run it.

TRUE    FALSE
A string in Python can be modified in place. I.e., the following is
legal Python:
str = "Hello"
str[0] = 'J'

TRUE    FALSE
In Bourne shell, ls * and ls "*" produce the same result

Question 2.  [4 MARKS]

You are given the following shell program which is stored in an executable file called noisytest:

```bash
#!/bin/sh
if test -f $1
then
echo "Found $1"
exit 0
else
echo "ERROR: file $1 not found"
exit 1
fi
```

Write a Bourne shell program that runs noisytest, but only prints the output to the screen if
noisytest exits with a value of 1. If noisytest returns 0, nothing should be printed

```bash
result='noisytest $1'
if [ $? -ne 0 ]
then
echo $result
fi
```

Question 3.  [3 MARKS]
Consider the following program:

```c
int main()
{
    int i, j;
    i = fork();
    if(i == 0) {
        printf("Child\n");
        exit(0);
    } else {
        printf("Parent\n");
    }

    j = fork();
    printf("Last line\n");
}
```

Part (a)  [1 MARK]
The number of processes that are created including the first process to execute main is 3

Part (b)  [2 MARKS]
Write the output of the above program in a valid order.

Parent  Child
Child  or  Parent
Last line  Last line
Last line  Last line
Question 4. [7 MARKS]
Write a C program that prints the number of directories contained in the immediate subdirectories of the current working directory. The number of directories contained in a directory is the number of hard links given by the stat struct for that directory. In the example below, adir has 3 hard links corresponding to its 3 subdirectories. If the current working directory was adir, then your C program will print out 9.

```
int main()
{
    DIR *dir = opendir(".");
    struct dirent *entry;
    struct stat sbuf;
    int sum = 0;

    while(entry = readdir(dir)) {
        if(stat(entry->d_name, &sbuf) == 0) {
            if(S_ISDIR(sbuf.st_mode)) {
                sum += sbuf.st_nlink;
            }
        }
    }
    printf("The number of subdirectories of . is %d\n", sum);
}
```
Question 5. [5 MARKS]

Write a Bourne shell program that prints out the names of all the executable files in the current working directory. The program should not print out the names of directories that have execute permissions. Do not use \texttt{ls}.

\begin{verbatim}
#!/bin/sh

for f in *
do
    if [ -f $f -a -x $f ]
    then
echo $f
    fi
done
\end{verbatim}
Question 6.  [6 MARKS]
Complete the following Python program. The program reads one line from standard input. The program prints out all the numbers in line except the largest and the smallest. The order of the printed numbers does not matter, and there is no limit to the number of numbers that appear on one line. One mark will be deducted from a correct solution that has more than one loop. A bonus mark will be awarded for a correct solution with no loops.

For example, if the input is “5.6 5.4 5.7 5.7 5.6” the output is “5.6 5.7 5.6” (in any order).

```python
#!/usr/local/bin/python
import sys

line = sys.stdin.readline()
list = line.split()
list.sort()
print " ".join(list[1:-1])
```