THE HONG KONG UNIVERSITY OF SCIENCE & TECHNOLOGY

COMP111: Software Tools

Midterm Exam

Spring 1999

24 March 1999

Student Name: ______________________________

Student Number: ______________________________

Lab Section: ______________________________

TA: ______________________________

Instructions:

1. There are 28 problems worth 100 points total.
2. Check that you have all 13 pages.
3. Answer all questions in the space provided. Rough work can be done only on the back pages..
4. Leave all pages stapled together.
5. The examination period will last for **120 minutes.**
6. Stop writing immediately when the time is up.

For Grading Purposes Only:

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Questions 1-11 are on Unix

1) (5 points) Command identification:

a) What command lists the first 15 lines of the file `letter1` in the current directory?

Answer: `head -15 letter1`

b) What command lists the last 15 lines of the file `letter1` in the current directory?

Answer: `tail -15 letter1`

c) What command tells who is the user?

Answer: `whoami`

d) What command tells the current working directory?

Answer: `pwd`

e) Which command can stop a background job?

Answer: `kill`

2) (2 points) A file called `names` contains the following text:

```
Mr. Bill
Bill Gates
Jackie Chan
President Woo
Bill Gates
Dr. Andrew Horner
President Bill Clinton
```

What is displayed on the screen after executing the following pipeline?

```
$ sort names | grep Bill | uniq | grep G
```

Answer: `Bill Gates`

3) (2 points) What is wrong with the following command?

$ cat file1 >file2 | sort >file3

Answer: cat has two outputs! (>file2 and the pipe)
Illegal, can only have one output.

4) (2 points) What is the current directory after the following commands?

```
$ whoami
gates
$ pwd
/homes/gates
$ cd ..
$ cd ~
$ cd .
```

Answer: `~gates` or: `/homes/gates`

5) (2 points) What is wrong with the following group of commands?

```
$ whoami
clinton
$ pwd
/homes/clinton
$ ls -l ~horner/111
   2 -rw------- 1 horner cs 154 Feb 4 16:38 file1
   2 -rw------- 1 horner cs  64 Feb 4 15:00 file2
   2 drwxr-xr-x 2 horner cs 512 Feb 8 18:01 dir1/
$ cp ~horner/111/file1 ~clinton
```

Answer: We can't copy file1 because clinton (who is not the owner) does not have read permission for this file.

6) (3 points) What command(s) would you use to set the permission of the file `letter1` so that the owner has only read and write permission, "group" has only read permission, and "other" has no permission? (Assume that `letter1` is in the current directory, and do not depend on the previous permission settings of `letter1`).

Answer:

```
chmod u=rw  letter1
chmod g=r   letter1
chmod o-rwx letter1
```

<u>or:</u>

```
chmod u+rw  letter1
chmod u-x  letter1
chmod g+r   letter1
chmod g-wx   letter1
chmod o-rwx letter1
```

<u>or:</u>

```
chmod 0640  letter1
```

7) (3 points) The file `file1` and `file2` exist in the current directory, and the following commands are executed:

```
$ ln -s file1 file3
$ ln file2 file4
$ rm file1
$ rm file2
```

Which of the following is true?

```
A)   file3 has the previous contents of file1,
     file4 has the previous contents of file2.
B)   file3 points to a file that does not exist,
     file4 points to a file that does not exist.
C)   file3 points to a file that does not exist,
     file4 has the previous contents of file2.
D)   file3 has the previous contents of file1,
     file4 points to a file that does not exist.
```

Answer: C

8) (4 points) After the following commands are executed, what are the contents of `file1`, `file2`, `file3`, and `file4`?

```
$ echo 1 > file1
$ cp file1 file2
$ ln file1 file3
$ ln -s file3 file4
$ rm file1
$ echo 2 > file1
$ echo 3 >> file2
$ cat file2 >> file1
```

Answer:

`file1:`

2
1
3

`file2:`

1
3

`file3:`

1

`file4:`

1

9) (2 points) How would you list the names of all the files in the current directory that end in a digit?

Answer: `ls *[0-9]`

or: `ls *[0123456789]`

10) (2 points) What is the working directory after executing the following commands?

```
$ cd ~horner/111/secret; (cd /usr; cd local/bin); \
cd ..; (cd ../tmp);  cd ../.;
```

Answer: ~horner

11) (5 points) The contents of the following files are:

<u>file1:</u>	<u>file2:</u>
Bill Gates1	Mr. Bill1
Bill Gates2	Mr. Bill2

What is output to the screen, and what are the contents of file1 and file2 after the following command?

```
$ (cat file1; head -1 file2) | tee file1; tail -1 <file1 | tee file2
```

Answer:
<u>screen:</u>
Bill Gates1
Bill Gates2
Mr. Bill1
Mr. Bill1

<u>file1:</u>
Bill Gates1
Bill Gates2
Mr. Bill1

<u>file2:</u>
Mr. Bill1

Questions 12-15 are on Shell Programming

12) (6 points) Write a shell program line that is equivalent to the following C++ line. Clearly indicate spaces with the "Δ" character.

```
n = (n+3) * 2;
```

Answer: ``n=`exprΔ\(Δ$nΔ+Δ3Δ\)Δ\*Δ2` ``

13) (5 points) Write a shell program that checks who the user is, and checks how many users are logged in, and prints out the result. Clearly indicate spaces with the "$_\Delta$" character. Make your output look like the following:

```
Hi horner! There are 3 users logged in.
```

Answer:

```
#!/bin/sh
user=`whoami`
numuser=`who∆|∆wc∆-l`
echo∆"Hi $user! There are $numuser users logged in."
```

14) (7 points) Write a shell program that prompts the user for three numbers, and prints out the biggest of the three. Clearly indicate spaces with the "Δ" character. Make your output look like the following:

```
Enter first number:
6
Enter second number:
10
Enter third number:
3
The max is: 10
```

Answer:

```
#!/bin/sh
echoΔ"Enter first number: "
readΔn1
echoΔ"Enter second number: "
readΔn2
echoΔ"Enter third number: "
readΔn3
ifΔ[Δ$n1Δ-geΔ$n2Δ-aΔ$n1Δ-geΔ$n3Δ]
then
     max=$n1
elifΔ[Δ$n2Δ-geΔ$n1Δ-aΔ$n2Δ-geΔ$n3Δ]
then
     max=$n2
else
     max=$n3
fi
echoΔ"The max is: $max"
```

15) (5 points) Write a shell program called `swap3` that swaps three files:

```
$ swap3 f1 f2 f3
```

When the program ends, the files will be swapped so that:

```
f1 has the contents originally in f3
f2 has the contents originally in f1
f3 has the contents originally in f2
```

Answer:

```
#!/bin/sh
mv $1 /tmp/$1
mv $3 $1
mv $2 $3
mv /tmp/$1 $2
```

or:

```
#!/bin/sh
mv $1 /tmp/$1
mv $2 /tmp/$2
mv $3 /tmp/$3
mv /tmp/$1 $2
mv /tmp/$2 $3
mv /tmp/$3 $1
```

Questions 16-28 are on Perl

16) (3 points) Rewrite the following using `until` and `unless` (instead of `while` and `if`):

```
#!/usr/local/bin/perl5 -w
$n = 1;
while($n <= 10){
     if($n%2){
          $n += 2;
     }
     $n++;
}
```

Answer:

```
#!/usr/local/bin/perl5 -w
$n = 1;
until($n > 10){
     unless($n%2==0){
          $n += 2;
     }
     $n++;
}
```

17) (2 points) What is the value of `$n` after executing the Perl statements in the previous question?

Answer: 12

18) (4 points) What is the output of this Perl program?

```
#!/usr/local/bin/perl5 -w
@a = (5,6,7,8);
$tmp = $a[0];
$a[0] = $a[-1];
$a[$#a] = $tmp;
$a[@a-2] = 9;
$a[-3] = 1;
print "@a\n";
```

Answer:
8 1 9 5

19) (4 points) Rewrite the following using `foreach` instead of `for`:

```
#!/usr/local/bin/perl5 -w
@a = (1,2,3);
$sum = 0;
for($i=0; $i<@a; $i++){
     $sum += $a[$i];
}
print "sum: $sum\n";
```

Answer:

```
#!/usr/local/bin/perl5 -w
@a = (1,2,3);
$sum = 0;
foreach $e (@a){
     $sum += $e;
}
print "sum: $sum\n";
```

20) (2 points) Is the following Perl program okay? If not, identify and fix the bugs. If it is okay, what is the output?

```
#!/usr/local/bin/perl5 -w
@a = (1,2,3);
@b = $a[1];
print "@b\n";
```

Answer:
Yes, okay.
2

21) (3 points) What is the value of `$n` after executing the following Perl statements?

```
#!/usr/local/bin/perl5 -w
$n = 0;
@a = (1,2,3);
$n += @a;
($m) = @a;
$n += $m;
```

Answer: 4

22) (3 points) What is the value of `@a` after executing the following Perl statements?

```
#!/usr/local/bin/perl5 -w
@a = (1,2,3);
foreach $n (@a){
     $n++;
}
@a = reverse @a;
```

Answer:
4 3 2

23) (2 points) What is wrong?

```
#!/usr/local/bin/perl5 -w
%a{"test",13} = (15,"bill");
while(($k,$v) = each(%a)){
     print "key $k, value $v\n";
}
```

Answer:
Should be `@a{"test",13}` instead of `%a{"test",13}`.

24) (3 points) What is the value of $n after the following Perl statements are executed?

```
$n = 4;
@a = (1,2,3);
while ( $n <= 13 ){
     if($n%2){
          $n += @a;
     }else{
          $n += $a[$n%3];
     }
}
```

Answer: 16

25) (5 points) What is the value of @a after the following Perl statements are executed?

```
$n = 5;
@a = 2;
@b = ($n,@a, 1);
unshift(@a, 4);
push(@a, 4);
$n = pop(@a);
unshift(@a, @b);
@a = reverse(@a);
push(@a, @b);
@a = sort(@a);
$n = pop(@a);
```

Answer: 1 1 2 2 2 4 5
(two 1's +1; three 2's +1; one 4 +1; one 5 +1; sorted +1)

26) (3 points) What is the output?

```
#!/usr/local/bin/perl5 -w
$bill{"Gates"} = "rich and famous";
@bill{"Clinton","Mr."} = qw(very nervous);
@a = values %bill;
%bill = reverse %bill;
print "@bill{sort @a}\n";
```

Answer:
```
Mr. Gates Clinton
```

27) (4 points) What is the output?

```
#!/usr/local/bin/perl5 -w
$bill{"Gates"} = "rich";
@bill{"Clinton","Mr."} = qw(very nervous);
@bob{qw(Bob Gates)} = qw(slow lazy);
@bill{keys %bob} = values %bob;
@a = sort values %bill;
print "bill: @a\n";
```

Answer:
```
bill: lazy nervous slow very
```

28) (7 points) Write a Perl program that given an array `@a`, moves only the odd-indexed elements into an array `@b`. For example, `@a=(0,1,2,"bill",4,5)` results in `@b=(1,"bill",5)`.

Answer:

```
for($i=0; $i<@a; $i++){
      if($i%2){
            push(@b, $a[$i]);
      }
}
```

Or:

```
for($i=0; $i<@a; $i++){
      if($i%2==1){
            @b = (@b, $a[$i]);
      }
}
```