

# UNIX SYSTEM PROGRAMMING FINAL EXAM

## Spring 2013

The following assumptions can be made throughout the exam:

**No variables have been declared other than those shown to be declared in the specific problem.**

**The shell is always tcsh.**

**Any scripts shown are always executable.**

**Unless otherwise specified, the directory where these commands are run is empty.**

**In answering the questions, if you believe that a specific problem produces an error message, say “ERROR”. If you believe it produces no output, say “EMPTY.” If an answer is on several lines, then put your answer on several lines.**

Some reminders:

- **When a regular expression has a \* as the first symbol, then it is interpreted as an actual \* symbol.**
- **I did not talk much in class about the -a and -d flags of ls. If you don't understand them, you can ignore them and you should still be able to get the right answers. (I only included them for technical reasons.)**
- **The grep -o flag prints only the matching pattern, not the rest of the line.**

**1. For the following, assume that this is the directory contents:**

```
% ls -ad
.  ..  .*  *...  *????  *?...?  ????  x...  x???
```

**What will each of the following produce ?**

- ls -ad \*?**
- ls -ad \*.**
- ls -ad .\***
- ls -ad ...**
- ls -ad \*???**

**2. Assume that the following commands are executed.**

```
% ls -ad
.  ..  .*  *...  *????  *?...?  ????  x...  x???
```

```
% ls -ad > ../words
% cp ../words .
```

**What then, will each of the following produce?**

- |                                    |                                   |
|------------------------------------|-----------------------------------|
| <b>a. cat words   fgrep '*?'</b>   | <b>f. cat words   grep '*?'</b>   |
| <b>b. cat words   fgrep '*.'</b>   | <b>g. cat words   grep '*.'</b>   |
| <b>c. cat words   fgrep '.*'</b>   | <b>h. cat words   grep '.*'</b>   |
| <b>d. cat words   fgrep '...'</b>  | <b>i. cat words   grep '...'</b>  |
| <b>e. cat words   fgrep '*???'</b> | <b>j. cat words   grep '*???'</b> |

3. What will each of the following produce?

- a. `echo "apple banana cherry durian" | cut -d " " -f2`
- b. `echo "apple banana cherry durian" | cut -d " " -c2`
- c. `echo "He said \"hi\"."`
- d. `echo "He said \"hi\"."`
- e. `echo "D\"E\"F"`
- f. `echo `expr 1 + 1``
- g. `expr 1/1`
- h. `echo "o o o o" | grep -o 'o o'`
- i. `echo "o o o o" | sed 's/./g'`
- j. `echo "o o o o" | sed ':x; s/./; tx'`
- k. `echo "o o o o" | sed -n ':x; s/./p; tx' | tr "\n" " "`
- l. `echo "o o o o" | awk '/b/'`
- m. `echo "o o o o" | awk 'NR=1'`
- n. `echo "o o o o" | awk -F "[ ]" '{ $1="b" }'`
- o. `echo "o o o o" | awk -Fo '{ $2="b" }1'`
- p. `echo "o o o o" | awk -F "*" '1'`

4. Assume that the following command is executed.

```
% cat script
#!/usr/bin/tcsh
exit $1
```

What then, will each of the following produce?

- a. `./script 3 || echo $?`
- b. `./script 4 && echo $?`
- c. `echo "$?a"`
- d. `set x = 0 ; echo "$?x"`
- e. `set y ; echo $y:q`
- f. `set y ; echo $?y`

5. Assume that the following commands are executed.

```
% ls
echo file1 file2 file3
% set A = \*
```

What then, will each of the following produce?

- a. `echo $A`
- b. `echo '$A'`
- c. `echo ` $A ``
- d. `echo $A:q`

## 6. Consider the following 4-line file:

```
% cat t
3
9
1
5
```

### What is the answer for each of the following?

To make it clear what is being asked for, here is an example:

```
Q: cat t | cat | tr "\n" ", "
A: 3,9,1,5,
```

a. cat t   sed 'd'	tr "\n" ", "
b. cat t   awk '/3/'	tr "\n" ", "
c. cat t   sed 'G;s/\n//g'	tr "\n" ", "
d. cat t   sed 'x'	tr "\n" ", "
e. cat t   sed 'h'	tr "\n" ", "
f. cat t   awk '{print \$A}'	tr "\n" ", "
g. cat t   sed -n '/2/p'	tr "\n" ", "
h. cat t   sed -n 'H;\${x;p}'	tr "\n" ", "
i. cat t   sed 'q'	tr "\n" ", "
j. cat t   sed -n '\$x;p'	tr "\n" ", "
k. cat t   sed -n 'x;H;\${x;P}'	tr "\n" ", "
l. cat t   awk '/[15]/{print \$i++}'	tr "\n" ", "
m. cat t   awk '{print \$( \$0 )}'	tr "\n" ", "
n. cat t   awk 'END{print \$0}'	tr "\n" ", "
o. cat t   sed '2\!d'	tr "\n" ", "
p. cat t   awk 'i%2{i++}END{print i}'	tr "\n" ", "
q. cat t   sed 'n;d'	tr "\n" ", "

## 7. Matching. Consider the following:

```
% head -15 a.txt
ALICE'S ADVENTURES IN WONDERLAND
Lewis Carroll

THE MILLENNIUM FULCRUM EDITION 3.0
```

CHAPTER I. Down the Rabbit-Hole

Alice was beginning to get very tired of sitting by her sister on the bank, and of having nothing to do: once or twice she had peeped into the book her sister was reading, but it had no pictures or conversations in it, 'and what is the use of a book,' thought Alice 'without pictures or conversation?'

So she was considering in her own mind (as well as she could, for the

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Now, for each of the commands shown below, decide what the proper output should be. Then look for that output in the list of choices attached at the end of this exam paper. If you find it, write the pair of letters for that choice into the space to the right of the question.

- If you don't find it, choose the option "BW". If there is no output, then choose "BV"

- More than one command may produce the same output. So you might use the same letter-pair in several places. I have intentionally put some incorrect choices into the output. So some letter-pairs will never be used.
- Spaces matter, as do blank lines. **The output only matches if it is a perfect match.**
- To make your searching faster, you can see that I have grouped the choices. They are kind of in alphabetical order – based on the first output line, and also based on shorter outputs going first.
- Some problems will be worth more points than others.

```

__a: head a.txt | grep .
__b: head a.txt | sed -n '1\!G;h;$p'
__c: head a.txt | sed -n '/WONDER/{n;p;}'
__d: head a.txt | sed '2\!d'
__e: head a.txt | egrep "^T|A|I"
__f: head a.txt | awk 'NF{print $0 "\n"}'
__g: head a.txt | awk 'NF{$0=++a " " $0};1'
__h: head a.txt | awk '{for (i=1; i<=NF; i++) s=s+$i}; END{print s}'
__i: head a.txt | tail -2 | awk '{print $2, $1}'
__j: head a.txt | tail -2 | awk '{ $2 = ""; print }'
__k: head a.txt | tail -1 | awk '{for (i=NF; i>0; i--) printf("%s ",$i);print ""}'
__l: head a.txt | awk '{y=x "\n" $0; x=$0};END{print y}'
__m: head a.txt | sed 's/the/the/p'
__n: head a.txt | awk '/do/{print x};{x=$0}'
__o: head a.txt | awk 'BEGIN{FS="\n";OFS=" ";RS=".";ORS=".\n"}{$1=$1;print}'
__p: head a.txt | sed '/^$/d;G' | sed 'n;d'
__q: head a.txt | sed '/the/{x;p;x;}'
__r: head a.txt | sed '=;N;s/\n/\t/'
__s: head a.txt | sed '/./=' | sed '/./N; s/\n/ /'
__t: head a.txt | sed -n '$='
__u: head a.txt | sed 's/[A-Z]/[a-z]/g'
__v: head a.txt | sed -n 's/\(.*\) o\(. * o\)/\1 O\2/p'
__w: head a.txt | sed '/was/s/the//p'
__x: head a.txt | awk '/the/{ total = total + NF }; END {print total}'
__y: head a.txt | awk '{i=NF/2; print $i, $i+1 }'
__z: head a.txt | sed '/^$/,/the/d'
__aa: head a.txt | sed 'n;n;n;n;d;'
__bb: head a.txt | sed -n '/^$/ {p;h;}; /./ {x; /./p;}'
__cc: set the = "the" ; head a.txt | grep '$the'
__dd: head a.txt | grep -ni "the" | sed -e 's_\([0-9]*\)::*_\1_' | tr "\n" " "
__ee: head a.txt | sed -n '1 p; 3p; 5p'

```

Here is the input file:

```
% head -15 a.txt
ALICE'S ADVENTURES IN WONDERLAND
Lewis Carroll

THE MILLENNIUM FULCRUM EDITION 3.0
```

CHAPTER I. Down the Rabbit-Hole

Alice was beginning to get very tired of sitting by her sister on the bank, and of having nothing to do: once or twice she had peeped into the book her sister was reading, but it had no pictures or conversations in it, 'and what is the use of a book,' thought Alice 'without pictures or conversation?'

So she was considering in her own mind (as well as she could, for the  
%

And here are the choices:

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**AA:**

ALICE'S ADVENTURES IN WONDERLAND  
Lewis Carroll

---

**AB:**

ALICE'S ADVENTURES IN WONDERLAND

---

**AC:**

ALICE'S ADVENTURES IN WONDERLAND  
Lewis Carroll

---

**AD:**

ALICE'S ADVENTURES IN WONDERLAND

---

**AE:**

ALICE'S ADVENTURES IN WONDERLAND  
Lewis Carroll  
bank, and of having nothing to do: once or twice she had peeped into the

---

**AF:**

ALICE'S ADVENTURES IN WONDERLAND  
Lewis Carroll

---

THE MILLENNIUM FULCRUM EDITION 3.0

---

**AG:**

ALICE'S ADVENTURES IN WONDERLAND  
Lewis Carroll

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THE MILLENNIUM FULCRUM EDITION 3.0

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CHAPTER I. Down the Rabbit-Hole

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**AH:**

ALICE'S ADVENTURES IN WONDERLAND Lewis Carroll THE MILLENNIUM FULCRUM EDITION 3.  
0 CHAPTER I.

Down the Rabbit-Hole Alice was beginning to get very tired of sitting by her sister on the bank, and of having nothing to do: once or twice she had peeped into the .

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**AI:**

ALICE'S ADVENTURES IN WONDERLAND  
Lewis Carroll  
THE MILLENNIUM FULCRUM EDITION 3.0  
CHAPTER I. Down the Rabbit-Hole

Alice was beginning to get very tired of sitting by her sister on the bank, and of having nothing to do: once or twice she had peeped into the

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**AJ:**

ALICE'S ADVENTURES IN WONDERLAND  
Lewis Carroll  
THE MILLENNIUM FULCRUM EDITION 3.0

CHAPTER I. Down the Rabbit-Hole

Alice was beginning to get very tired of sitting by her sister on the bank, and of having nothing to do: once or twice she had peeped into the

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**AK:**

ALICE'S ADVENTURES IN WONDERLAND  
Lewis Carroll  
THE MILLENNIUM FULCRUM EDITION 3.0

CHAPTER I. Down the Rabbit-Hole

Alice was beginning to get very tired of sitting by her sister on the

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**AL:**

ALICE'S ADVENTURES IN WONDERLAND

Alice was beginning to get very tired of sitting by her sister on the

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**AM:**

ALICE'S ADVENTURES IN WONDERLAND  
Lewis Carroll  
THE MILLENNIUM FULCRUM EDITION 3.0

CHAPTER I. Down the Rabbit-Hole

Alice was beginning to get very tired of sitting by her sister on the bank, and of having nothing to do: once or twice she had peeped into the

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**AN:**

ALICE'S ADVENTURES IN WONDERLAND  
Lewis Carroll  
THE MILLENNIUM FULCRUM EDITION 3.0

CHAPTER I. Down the Rabbit-Hole

Alice was beginning to get very tired of sitting by her sister on the bank, and of having nothing to do: once or twice she had peeped into the

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**AO:**

1 ALICE'S ADVENTURES IN WONDERLAND  
2 Lewis Carroll

4 THE MILLENNIUM FULCRUM EDITION 3.0

7 CHAPTER I. Down the Rabbit-Hole

9 Alice was beginning to get very tired of sitting by her sister on the  
10 bank, and of having nothing to do: once or twice she had peeped into the

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**AP:**

ALICE'S ADVENTURES IN WONDERLAND  
Lewis Carroll

THE MILLENNIUM FULCRUM EDITION 3.0

CHAPTER I. Down the Rabbit-Hole  
CHAPTER I. Down the Rabbit-Hole

Alice was beginning to get very tired of sitting by her sister on the  
Alice was beginning to get very tired of sitting by her sister on the  
bank, and of having nothing to do: once or twice she had peeped into the  
bank, and of having nothing to do: once or twice she had peeped into the

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**AQ:**

ALICE'S ADVENTURES IN WONDERLAND

Lewis Carroll

THE MILLENNIUM FULCRUM EDITION 3.0

CHAPTER I. Down the Rabbit-Hole

Alice was beginning to get very tired of sitting by her sister on the  
bank, and of having nothing to do: once or twice she had peeped into the

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**AR:**

ALICE'S ADVENTURES IN WONDERLAND  
Lewis Carroll

THE MILLENNIUM FULCRUM EDITION 3.0

CHAPTER I. Down the Rabbit-Hole

Alice was beginning to get very tired of sitting by her sister on the  
bank, and of having nothing to do: once or twice she had peeped into the

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**AS:**

ALICE'S ADVENTURES IN WONDERLAND  
Lewis Carroll

THE MILLENNIUM FULCRUM EDITION 3.0

CHAPTER I. Down the Rabbit-Hole

Alice was beginning to get very tired of sitting by her sister on  
Alice was beginning to get very tired of sitting by her sister on  
bank, and of having nothing to do: once or twice she had peeped into the

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**AT:**

1 ALICE'S ADVENTURES IN WONDERLAND  
2 Lewis Carroll  
3  
4 THE MILLENNIUM FULCRUM EDITION 3.0

5

6

7 CHAPTER I. Down the Rabbit-Hole

8

9 Alice was beginning to get very tired of sitting by her sister on the  
10 bank, and of having nothing to do: once or twice she had peeped into the

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**AU:**

ADVENTURES IN  
Lewis Carroll

MILLENNIUM FULCRUM

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do: once

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**AV:**

THE MILLENNIUM FULCRUM EDITION 3.0  
Alice was beginning to get very tired of sitting by her sister on the

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**AW:**

THE MILLENNIUM FULCRUM EDITION 3.0  
CHAPTER I. Down the Rabbit-Hole  
Alice was beginning to get very tired of sitting by her sister on the  
bank, and of having nothing to do: once or twice she had peeped into the

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**AX:**

CHAPTER I. Down the Rabbit-Hole

Alice was beginning to get very tired of sitting by her sister on the  
bank, and of having nothing to do: once or twice she had peeped into the

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**AY:**

CHAPTER I. Down the Rabbit-Hole  
Alice was beginning to get very tired of sitting by her sister on the  
bank, and of having nothing to do: once or twice she had peeped into the

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**AZ:**

CHAPTER I. Down the Rabbit-Hole

Alice was beginning to get very tired of sitting by her sister on 4  
bank, and 13 having nothing 9 do: once or twice she had peeped into 4

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**BA:**

Alice was beginning to get very tired of sitting by her sister on the

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**BB:**

Alice was beginning to get very tired of sitting by her sister on  
bank, and of having nothing to do: once or twice she had peeped into the

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**BC:**

Alice beginning to get very tired of sitting by her sister on the  
bank, of having nothing to do: once or twice she had peeped into the

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**BD:**

Alice was beginning to get very tired of sitting by her sister on the  
bank, and of having nothing to do: once or twice she had peeped into the

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**BE:**

Alice was beginning to get very tired Of sitting by her sister on the  
bank, and of having nothing to do: Once or twice she had peeped into the

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**BF:**

bank, and of having nothing to do: once or twice she had peeped into the

NYVPR'F NQIRAGHERF VA JBAQREYNAQ

Yrjvf Pneeby

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**BG:**

bank, and of having nothing to do: once or twice she had peeped into the  
Alice was beginning to get very tired of sitting by her sister on the

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**BH:**

bank, and of having nothing to do: once or twice she had peeped into the  
Alice was beginning to get very tired of sitting by her sister on the

CHAPTER I. Down the Rabbit-Hole

THE MILLENNIUM FULCRUM EDITION 3.0

Lewis Carroll

ALICE'S ADVENTURES IN WONDERLAND

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**BI:**

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eht otni depeep dah ehs eciwt ro ecno :od ot gnihton gnivah fo dna ,knab

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**BJ:**

Lewis Carroll

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**BK:**

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**BR:**

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**BS:**

32

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**BT:**

2

---

**BU:**

4 7 9 10

---

**BV:**

<No output>

---

**BW:**

Other (output is not listed)

---