

HW 3

Due: Tue Feb. 28

CS442: Great Insights in Computer Science
Michael L. Littman, Spring 2006

Show Your Work

- We can't give you feedback on your understanding if we can't see how you worked out the problems.
- Please include some explanation of your answers instead of simply writing the answer.
- Also, you can work together, but please don't copy each other's work: write up your answers separately.

1. Exponential Right?

Which of these Newsweek excerpts use the term “exponentially” correctly? If it is correct, give the exponential equation it implies.

- a. Current approaches aren't working; even though home users and many companies started filtering their e-mail two years ago, the overall amount of junk mail has ballooned —**exponentially**.
- b. Once I got into digital photography the number of pictures I took **exponentially** increased.
- c. Since 1986, when e-filing began with just 25,000 tax returns filed online, the number of e-filed returns has risen **exponentially**, with more than 68 million individual returns e-filed in 2005—that's more than 50 percent of all returns.
- d. "We are **exponentially** better than we were on that dreadful September morning," says Maura Harty, assistant secretary of state for consular affairs.

2. Songs

- How many syllables do you sing in n verses of each of these songs? Choose from $O(n)$, $O(n \lg n)$, $O(n^2)$, and $O(n^2 \lg n)$.
- Verses are separated by blank lines in what follows.

i. Green & Speckled Frogs

Four green and speckled frogs
Sat on a speckled log,
Eating the most delicious bugs - yum yum
One jumped into the pool
Where it was nice and cool
Now there are three green speckled
frogs Glub, glub !

Three green and speckled frogs
Sat on a speckled log,
Eating the most delicious bugs - yum yum
One jumped into the pool
Where it was nice and cool
Now there are two green speckled frogs
Glub, glub !

Two green and speckled frogs
Sat on a speckled log,
Eating the most delicious bugs - yum yum
One jumped into the pool
Where it was nice and cool
Now there is one green speckled frog
Glub, glub !

One green and speckled frog
Sat on a speckled log,
Eating the most delicious bugs - yum yum
It jumped into the pool
Where it was nice and cool
Now there are no green speckled frogs
Glub, glub !

ii. SciFi Song (from net)

I'll give you one, just to have some fun,
One for the check that never got done,
And the starship lifts on time.

I'll give you two that'll do for you,
Two for the bearings not quite true,
One for the check that never got done,
And the starship lifts on time.

I'll give you three that'll keep you free,
Three for the warnings none could see,
Two for the bearings not quite true,
One for the check that never got done,
And the starship lifts on time.

I'll give you four, you won't need more,
Four for the seals around the door,
Three for the warnings none could see,
Two for the bearings not quite true,
One for the check that never got done,
And the starship lifts on time.

I'll give you five, just to stay alive,
Five for the shielding on the drive,
Four for the seals around the door,
Three for the warnings none could see,
Two for the bearings not quite true,
One for the check that never got done,
And the starship lifts on time.

I'll give you six when your eyes play tricks,
Six for the drinks you shouldn't mix,
Five for the shielding on the drive,
Four for the seals around the door,
Three for the warnings none could see,
Two for the bearings not quite true,
One for the check that never got done,
And the starship lifts on time.

iii. Anything You Can Do

Anything you can do,
I can do better.
I can do anything
Better than you.

No, you can't.
Yes, I can. No, you can't.
Yes, I can. No, you can't.
Yes, I can,
Yes, I can!

Anything you can be
I can be greater.
Sooner or later,
I'm greater than you.

No, you're not. Yes, I am.
No, you're not. Yes, I am.
No, you're NOT!. Yes, I am.
Yes, I am!

Any note you can reach
I can go higher.
I can sing anything
Higher than you.

No, you can't. (High)
Yes, I can. (Higher) No, you can't.
(Higher)
Yes, I can. (Higher) No, you can't.
(Higher)
Yes, I can. (Higher) No, you can't.
(Higher)
Yes, I can. (Higher) No, you can't.
(Higher)
Yes, I CAN! (Highest)

Anything you can buy
I can buy cheaper.
I can buy anything
Cheaper than you.

Fifty cents?
Forty cents! Thirty cents?
Twenty cents! No, you can't!
Yes, I can,
Yes, I can!

Anything you can say
I can say softer.
I can say anything
Softer than you.

No, you can't. (Softly)
Yes, I can. (Softer) No, you can't.
(Softer)
Yes, I can. (Softer) No, you can't.
(Softer)
Yes, I can. (Softer)
YES, I CAN! (Full volume)

Any note you can hold
I can hold longer.
I can hold any note
Longer than you.

No, you can't.
Yes, I can No, you can't.
Yes, I can No, you can't.
Yes, I can
Yes, I-I-I-I-I-I-I-I No, you C-A-A-A-
A-A-A-A-A-A-A-A-N'T--
CA-A-A-A-N! (Cough, cough!)
Yes, you ca-a-a-an!

3. Graph Example

- Draw an example of a graph based on something from the real world.
 - i. What do the nodes represent?
 - ii. What do the edges represent?
 - iii. Are the edges directed or undirected?
 - iv. Explain what a path means in your graph.
 - v. Is it connected?

4. Sort Comparison

- A list: Anthropology, English, Economics, Political Science.
 - i. How many comparisons does Insertion Sort do to alphabetize this list?
 - ii. How many comparisons does Merge Sort do to alphabetize this list?

Extra Credit

- The remaining problems require a bit more thought!
- Try these for fun.

5. Best/Worst Merges

- Let's say merge sort is going to sort the numbers 1, 2, 3, 4, 5, 6, 7, 8.
 - i. For what order will Merge Sort make the least comparisons? How many?
 - ii. For what order will Merge Sort make the most comparisons? How many?