Rules

- You may work together, but you are expected to turn in your own writeup of answers.
- HW is due on sakai by the beginning of class.
- Better to hand an answer in late than not at all.
- Email questions to TAs/professor or ask in class.
1. Mystery Routines

The Scratch scripts below solve decision problems on lists: given list $L$, they say either Yes or No. Which routine answers each of these questions?

a. Does the list contain the number 1?

b. Is the list sorted in increasing order?

c. Does the first element in the list appear elsewhere in the list?
2. Song Growth

How many syllables do you sing in \( n \) verses of the following three songs? Choose from \( O(n) \), \( O(n \lg n) \), \( O(n^2) \), and \( O(n^2 \lg n) \).

Verses are separated by blank lines.

a.

b.

c.

a. Girl Named Fred

I’m in love with a girl named Fred.  
My reasons must be clear:  
You'll stand right up and cheer!  
With an F and an R and an E and a D,  
And an F-R-E-D, Fred! Yeah!

I'm in love with a girl named Fred.  
She drinks just like a Lord!  
So sing a merry drinking song,  
And let the wine be pour'd!  
Fill the bowl to overflowing,  
Raise the goblet high!  
With an F and an R and an E and a D,  
And an F-R-E-D, Fred! Yeah!

I’m in love with a girl named Fred.  
She sings just like a Bird!  
You'll be left completely speechless,  
When her gentle voice is heard!  
Doobie doobie wah wah wah!  
Fill the bowl to overflowing,  
Raise the goblet high!  
With an F and an R and an E and a D,  
And an F-R-E-D, Fred! Yeah!

I’m in love with a girl named Fred.  
She wrestles like a Greek!  
You will clap your hands in wonder,  
At her fabulous technique!  
Clap clap-clap-clap clap-clap-clap-clap.  
Doobie doobie wah wah wah!  
Fill the bowl to overflowing,  
Raise the goblet high!  
With an F and an R and an E and a D,  
And an F-R-E-D, Fred! Yeah!

I’m in love with a girl named Fred.  
Who dances with such grace!  
You are bound to sing her praises,  
‘Til you’re purple in the face!  
Bravo! Bravo! Bravissimo!  
Bravo! Bravo! Bravissimo!  
Clap clap-clap-clap clap-clap-clap-clap.  
Doobie doobie wah wah wah!  
Fill the bowl to overflowing,  
Raise the goblet high!  
With an F and an R and an E and a D,  
And an F-R-E-D, Fred! Yeah!

I’m in love with a girl named Fred.  
She’s musical to boot.  
She will set your feet tapping,  
When she plays upon her lute!  
Tap Tap-tap Tap-tap tap.  
Bravo! Bravo! Bravissimo!  
Bravo! Bravissimo!  
Clap clap-clap-clap clap-clap-clap-clap.  
Doobie doobie wah wah wah!  
Fill the bowl to overflowing,  
Raise the goblet high!  
With an F and an R and an E and a D,  
And an F-R-E-D, Fred! Yeah!

A clever, clownish wit!  
When she does her funny pantomime,  
Your sides are sure to split!  
Ha-ha-ha-ha, Ho-ho-ho-ho, Ha-ha-ha-ha-ha!  
Tap Tap-tap Tap-tap tap.  
Bravo! Bravo! Bravissimo!  
Bravo! Bravissimo!  
Clap clap-clap-clap clap-clap-clap-clap.  
Doobie doobie wah wah wah!  
Fill the bowl to overflowing,  
Raise the goblet high!  
With an F and an R and an E and a D,  
And an F-R-E-D, Fred! Yeah!
b. L-Y

You're wearing your squeaky shoes
And right there taking a snooze
Is a tiger, so how do you walk on by?
Silently ... silently ... silent ... L-Y

You're a secret agent man
Who's after the secret plan
How do you act so they don't know you're a spy?
Normally ... normally ... normal ... L-Y

At an eating contest you boast
That you can eat the most
How do you down your fiftieth piece of pie?
Eagerly ... eagerly ... eager ... L-Y

On the lake your boat upset
And your clothes got soaking wet
How do you stand and wait for them to dry?
D-d-d-d-d patiently ... d-d-d-d-d patiently ... patient ... L-Y

In the public library
You fall and you hurt your knee
But the sign says "quiet please," so how can you cry?
Quietly .... quietly .... quiet ... L-Y

As you walk along the street
A porcupine you meet
How do you shake his hand when he says hi?
Carefully ... carefully .... careful ... L-Y

You enter a very dark room
And sitting there in the gloom
Is Dracula! Now how do you say goodbye?
Immediately ... immediately ... immediate ... L-Y

[by Tom Lehrer]

c. Little Monkeys

Five little monkeys, swinging from a tree,
Teasing Mr. Alligator, “Can’t catch me!”
Along comes Mr. Alligator, quiet as can be,
SNAP! that monkey right out of the tree.

Four little monkeys, swinging from a tree,
Teasing Mr. Alligator, “Can’t catch me!”
Along comes Mr. Alligator, quiet as can be,
SNAP! that monkey right out of the tree.

Three little monkeys, swinging from a tree,
Teasing Mr. Alligator, “Can’t catch me!”
Along comes Mr. Alligator, quiet as can be,
SNAP! that monkey right out of the tree.

Two little monkeys, swinging from a tree,
Teasing Mr. Alligator, “Can’t catch me!”
Along comes Mr. Alligator, quiet as can be,
SNAP! that monkey right out of the tree.

One little monkey, swinging from a tree,
Teasing Mr. Alligator, “Can’t catch me!”
Along comes Mr. Alligator, quiet as can be,
SNAP! that monkey right out of the tree.

No little monkeys, swinging from a tree,
Away swims Mr. Alligator, as full as can be.
3. Exponential Right?

For each of these Newsweek excerpts, determine whether it uses the term “exponentially” correctly.

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.

4. Play It Again

(A) A Twister spinner has equal probability of coming up Red, Yellow, Blue, or Green. How many times would you need to spin before Blue comes up, on average?

(B) How many times, on average, would you need to spin before getting a primary color (Red, Blue, or Yellow)?
5. Sing, Sing a Song

• “The House That Jack Built” is $O(n^2)$.

• Verse 1 is: This is (1) the House that Jack built. Verse 11 is on the next page. You can figure out all the other verses by looking at Verse 11.

• Make a Scratch program that uses “say” to print out all the words. It should use a variable $i$ that controls which verses (1 through $i$) will be said. Use loops or subroutines so you don’t repeat the same words in the script.

• The song should start when the sprite is clicked.

Verse 11

• This is (11) the Farmer who sowed the corn that fed (10) the Cock that crowed in the morn that waked (9) the Priest all shaven and shorn that married (8) the Man all tattered and torn that kissed (7) the Maiden all forlorn that milked (6) the Cow with the crumpled horn that tossed (5) the Dog that worried (4) the Cat that killed (3) the Rat that ate (2) the Malt that lay in (1) the House that Jack built.