1. Sock Sorting Bugs

Each of the sock sorting routines below has a fatal flaw (bug). Match the description of a flaw to the name of the sorting routine that has the flaw.

a. When there’s only two socks left, tries to grab a third.

b. Replaces a sock that’s already been matched.

c. Replaces the same sock twice in a row.

d. Forgets to replace socks if they don’t match.
Sock Sorters

def sorterA():
    a = getSock()
    b = getSock()
    if not match(a,b):
        replaceSock(a)
        replaceSock(a)

def sorterB():
    a = getSock()
    b = getSock()
    while match(a,b):
        replaceSock(a)
        a = getSock()

def sorterC():
    a = getSock()
    b = getSock()
    if match(a,b):
        return

def sorterD():
    a = getSock()
    b = getSock()
    c = getSock()
    if not match(a,b):
        replaceSock(a)
        replaceSock(b)
        replaceSock(c)

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:
When she shows you all how strong she is,
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 poured!
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! 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 a-tapping,
When she plays upon her lute!
Tap Tap Tap Tap-tap tap.
Bravo! Bravo! Bravissimo!
Bravo! Bravissimo!
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.
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-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?

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.
4. Sing, Sing a Song

- Describe a generalized version of a real song that can be sung for \( n \) verses.
- Show us the first 3 or 4 verses.
- Tell us how the number of syllables grows with the number of verses (\( O(n) \), \( O(n^2) \), \( O(n \log n) \), ...).