HW11 DUE Mon May 10, 9:00AM-NO DEAD CAT

For **Programming Problems** Send your code to Emily by email. Send the actual .java/.py/ect file. You need to use your .umd email address or it will not send. In your pdf, you must have the output your code provides. You can screenshot this or type it in. Hint: Use Python.

1. (0 points but if you miss the final that means you got this wrong retroactively and you will lose a lot of points). When is the FINAL? By what day do you need to tell Dr. Gasarch that you cannot make the midterm (if you cannot and know ahead of time)?

   HINT The TIME of the Final is Monday May 17, 8:00PM-10:15PM. This is NOT the time on the official School Schedule-of-finals.

2. (30 points)

   Find a closed form for the following recurrence.

   $a_0 = 0$

   $a_1 = 0$

   $(\forall n \geq 2)[a_n = 3a_{n-1} - 2a_{n-2} + 3^n]$

   GOTO NEXT PAGE

3. (30 points) (The following is a TRUE story).

There are two book companies that both sell books on Amazon, Bordeebook and Profnath books (those are there real names).

FACT ONE If Profnath books is charging x for a book, Bordeebook will change their price to $1.23x$.

FACT TWO If Bordeebook is charging x for a book, Profnath will change their price to $0.99x$.

The book *The making of a fly* was originally listed on both sites at $70.00. They SIMULTANEOUSLY change their prices.

Let b_n be the price Bordeebook is charging after n iterations.

Let p_n be the price Profnath is charging after n iterations.

Note that

$b_0 = 70$

$p_0 = 70$.

$(\forall n \geq 1)[b_n = 1.23p_{n-1}]$.

$(\forall n \geq 1)[p_n = 0.99b_{n-1}]$.

And NOW for the problem

(a) Obtain a closed form formula for b_{2n} and b_{2n+1}.

(b) Obtain a closed form formula for p_{2n} and p_{2n+1}.

(c) This problem had parameters 1.23 and 0.99 and (if you did the problem correctly) the four quantities in the last two problems both go to infinity (the list price on Amazon eventually went up to $23,000,000, which is a lot for a book that only got 4.1 stars). Find $1.1 < c < 1.3$ and $0.8 < d < 0.9$ such that IF (1) Bordeebook will change their price to cx, and (2) Profnath will change their price to dx, THEN the price will NOT goto infinity.

(WARNING: This DOES NOT NEED the fancy techniques for recurrences we have been talking about lately.)
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4. (30 points) Reread the proof that the Liouville numbers are transcendental. We proved that

   if α is a Liouville number and $p(x)$ is a polynomial WITH COEFFICIENTS IN Z then $p(\alpha) = 0$.

   Where in the proof did we use that the coefficients are in Z?

5. (10 points) The following are true:

   FACT ONE Bill is not a cool kid. He does not know Python.

   FACT TWO Emily is not a cool kid. She does know Python.

   Do either Bill or Emily's existence show that the following statement is false:

   All the cool kids know Python.

6. (0 points, but I am curious) Is the statement

   All the cool kids know muffin mathematics

   true?