

SetDirectory@"C:\\drorbn\\AcademicPensieve\\Classes\\16-475-ProblemSolving"

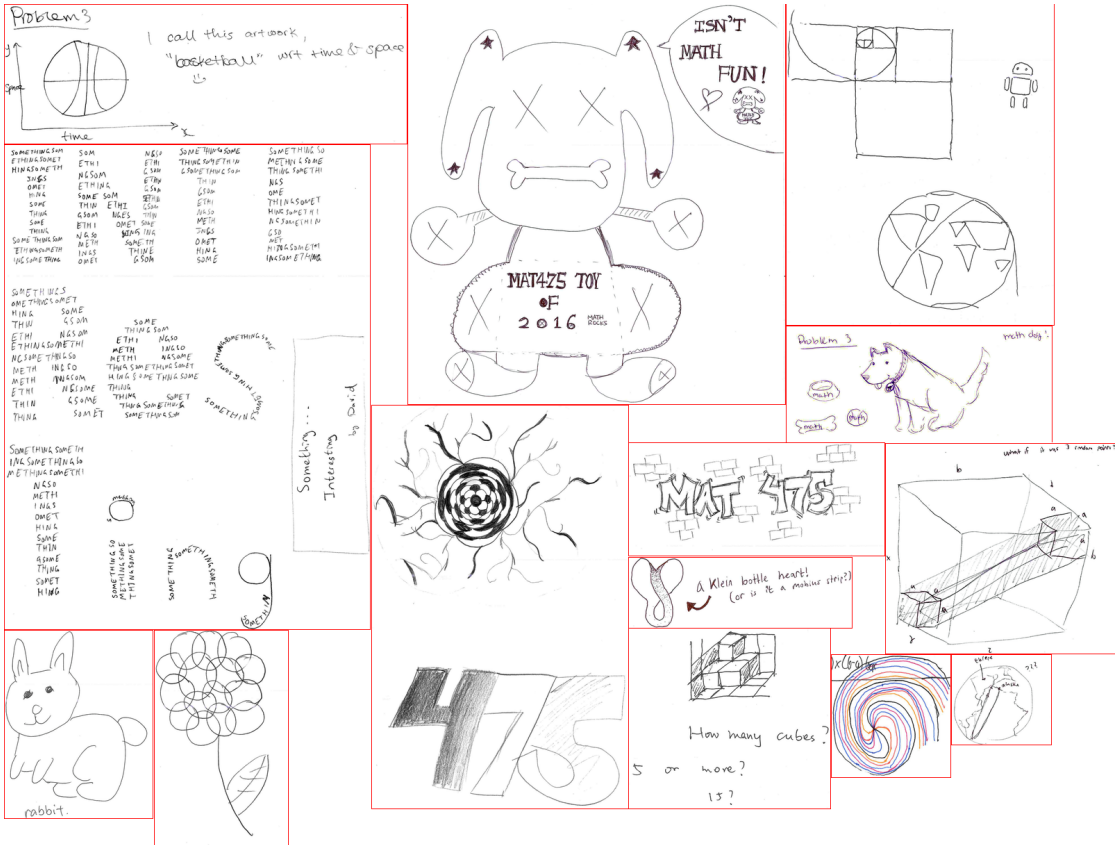
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col2 = ImageCollage [

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Method -> "ClosestPacking", Background -> White, Padding -> Red, ImagePadding -> 4]



Export ["Quiz2StudentFigures/Collage.png", col2]

Quiz2StudentFigures/Collage.png


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col3 = ImageCollage [
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  "Fit", 1600,
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]
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3) The question about n-sums "Show $a(n-2) + a(n-1) = a(n)$ "
 This shows that $a(n)$ is the $(n+1)^{th}$ fibonacci #.
Translation:
 $a(1)=1$ base case. Now let $a(n-2)=k_1+k_2$ } k_1 # representations why in 1
 $a(n-2)$ } k_2 # rep. why in 2
 So, $a(n)$ is made by $\binom{k_1+k_2}{k_1}$ ways to choose k_1 of $a-2$ why in 1
 and $\binom{k_1+k_2}{k_2}$ ways to choose k_2 of $a-2$ why in 2
 $\Rightarrow a(n) = \binom{k_1+k_2}{k_1} + \binom{k_1+k_2}{k_2}$
 Similarly, $a(n) = [k_1, k_2] + [k_1, k_2] \cdot a(n-1) + a(n-2)$

Problem 3: Recat favorite problem
 Lesson 1.3.9 & 1.3.10.
 $n = a_1 + a_2 + \dots + a_k$ $0 \leq a_i$ non negative
 $n+k = (a_1+1) + (a_2+1) + \dots + (a_k+1)$ $0 < a_i+1$ positive only
 That transformation preserves the question.

3) I found it algebraically fun!
 My favorite is the number of ways to write n as a sum of 3 parts.


3) Find maximum bipartite pairs in a graph.
 Given a (V,E) is bipartite find maximum number of bipartite pairs.
 $a_1 \dots a_n$ vs $b_1 \dots b_m$ if we chose (a_i, b_j) so pass
 $a_i \dots a_n$ vs $b_1 \dots b_m$ if choose (a_i, b_j) so pass
 (Network flow can solve this)


3) Finding the area of a triangle in 2 different ways.
 $\frac{1}{r} = \frac{1}{p_1} + \frac{1}{p_2} + \frac{1}{p_3}$

 Total area of triangle = $0.5 r (a+b+c)$
 $r = \frac{2(\text{Total area of triangle})}{a+b+c}$
 $\frac{1}{r} = \frac{a+b+c}{2(\text{Total area of triangle})}$
 $\frac{S}{2(\text{Total area})} = \frac{1}{P_1}$
 $\frac{b}{2(\text{Total area})} = \frac{1}{P_2}$
 $\frac{c}{2(\text{Total area})} = \frac{1}{P_3}$
 So $\frac{1}{r} = \frac{1}{P_1} + \frac{1}{P_2} + \frac{1}{P_3}$

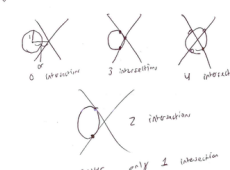
Problem 3: NOT from the book or handout but
 Fermat's Last Theorem was solved through the formulation of an equivalent problem to do with elliptic curves.
 Like the one in 1.3.12 in the textbook it seems it was interesting to solve, not requiring many less things of rules.
 My favorite "formulate equivalent problem" is:
 $\sum_{k=0}^n \binom{n}{k} \binom{m-p}{n-k} = \binom{m}{n}$ We can formulate the equivalent problem, we can interpret the problem in another way, making it much easier to be justified.

Another Favorite "formulate an Equivalent Problem" problem: Prove that the product of n consecutive integers is divisible by n!
 Another Favorite "formulate an Equivalent Problem" problem: Let a, b be natural number. What's the largest number that cannot be written as a positive linear combination of a, b . How many numbers can't be written as a natural linear combination of a, b .
 Another Favorite: Suppose we draw n lines in general position through a circle. What's the maximal number of distinct regions we can get?
 $1, 2, 4, 7, \dots$

Question: Add and find the sum of:
 $1+2+3+\dots+100$
Soln: Let $S = 1+2+3+\dots+100$
 $\Rightarrow S = 100+99+98+\dots+1$
 Add the S s:
 $\Rightarrow S = 1+2+3+\dots+100$
 $+ 100+99+98+\dots+1$
 $\hline 101+101+101+\dots+101$
 Since we added the 2 S s:
 $\frac{101 \times 100}{2} = 5050$
Answer: 5050. -very clever solution -not part of the Chapter but still fun LOL

Use a combinatorial argument to show that
 $\binom{2n}{n} = \binom{n}{0}\binom{n}{n} + \binom{n}{1}\binom{n}{n-1} + \binom{n}{2}\binom{n}{n-2} + \dots + \binom{n}{n}\binom{n}{0}$


3) 
Problem 3:
 $x^4 + x^3 + x^2 + x + 1 = 0$
 has no real solutions but complex solutions.

3) $y^2 = x^2$ is equivalent to $y^2 - (x-i)^2 = 1$

 0 intersection, 3 intersection, 4 intersection, 2 intersection, never, only 1 intersection.

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Export ["Quiz3StudentProposals/Collage.png", col3]
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Quiz3StudentProposals/Collage.png