Quiz

Graded

Student

Sara Huston

Total Points

16 / 16 pts

Question 1

P1 — **5** / 5 pts

+ **0 pts** Correct

+ **5 pts** Point adjustment

Question 2

P2 — **5** / 5 pts

+ **0 pts** Correct

+ **5 pts** Point adjustment

Question 3

P3 — **6** / 6 pts

+ **0 pts** Correct

+ **6 pts** Point adjustment

Q1 P1

5 Points

Do all 3 problems; 100% is for 10 pts (160% for all). Partial credit will given ranging from no credit to full credit. Show all of your work on the quiz paper. Don't forget to put your name, which is the pledge.

P1. In how many ways 1 orange, 1 grapefruit and 8 "identical" apples can be distributed among 3 children, assuming that each of them receives at least one piece of fruit?

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Q2 P2

5 Points

P2. Check that $\sum_{r=0}^{n}(-2)^r\binom{n}{r} = 1 - 2\binom{n}{1} + 4\binom{n}{2} + \ldots + (-2)^r\binom{n}{r} + \ldots + (-2)^n$
cannot be greater than 1 for any $n > 0$.

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Q3 P3

6 Points

P3. Consider the board of size $n \times m$ for even $n > 1$ and even $m > 1$. Remove a 2×2 square anywhere. Show that the rest is perfectly coverable by dominos (4 points). Show that the same is true if m is odd (2 points).

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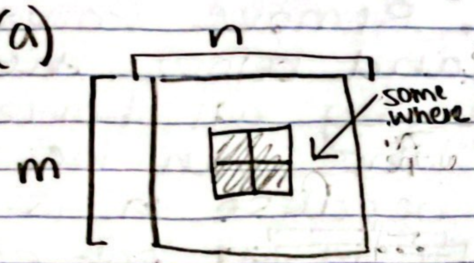
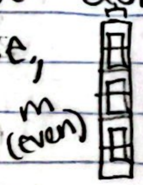
3. Board of size $n \times m$ for even $n > 1$ and even $n > 1$. Remove a 2×2 square, anywhere. Show the rest is perfectly coverable by dominos. m(even) $\times$ n(even)

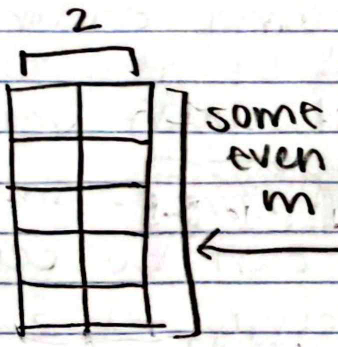
(a)



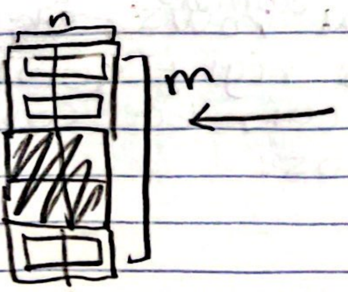
Let's reduce to the case of a 2 by m square. To do so, we can start by removing all columns to the left & right of the punture. Since m is even this can be done by all vertical dominos i.e.,



. After we are left with $2 \times m$.



Now, the puncture is somewhere in $2 \times m$. To cover it, we can now cover each row above or below it with a horizontal domino.



Thus, it is perfectly coverable by: all columns to left/right with vertical dominos & all $m \times 2$ rows above covered with horizontal dominos.

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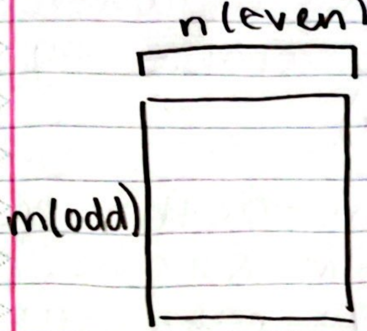
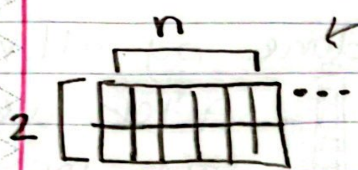
3.(b) m is odd; n is even

2 x 2 puncture



Lets reduce to a case of $2 \times n$. Remove rows above and below the puncture by all horizontal dominos. this can be achieved because n is even, so  for each row above & below the puncture.



Thus, we are left with $2 \times n$ with the puncture somewhere inside. The remaing dominos left and right of the puncture can be covered with vertical dominos : . thus, m (odd) x n (even) can be perfectly covered by reducing to $2 \times n$ with horizontal domino rows, then all remaing left & right columns of the puncture can be covered by vertical dominos.

Example:

$n = 4$ $m = 5$