Directions: You may work to solve these problems in groups, but all written work must be your own. Show all work.

1. Let $f(n)$ be the number of ordered lists of positive integers that sum to n. For example:

n	$f(n)$	Lists with sum n
1	1	(1)
2	2	(1,1), (2)
3	4	(1,1,1), (2,1), (1,2), (3)

   It is pretty easy to guess a formula for $f(n)$. It is more difficult to give an argument that shows your formula for $f(n)$ is correct. Argue that your formula is correct by using a graphical representation of the integer n as a row of n dots.

2. Poker hands.

   (a) A *full house* is a poker hand in which 3 cards have the same rank and the other 2 also have the same rank (e.g. 3 of hearts, 3 of spades, 3 of clubs, 7 of diamonds, 7 of clubs). How many poker hands are full houses? What are the odds of being dealt a full house from a freshly shuffled deck?

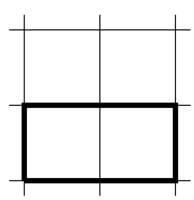
   (b) A *near flush* is a poker hand in which 4 cards belong to a single suit and the remaining card belongs to a different suit. How many poker hands are near flushes? What are the odds of being dealt a near flush from a freshly shuffled deck?

3. How many ways are there to arrange the letters of the word 'SUSPICIOUS':

   (a) with no additional restrictions?

   (b) if no two S's are consecutive?

4. How many rectangles are created when n horizontal lines intersect n vertical lines? (Note: a square is a rectangle, so squares are included.) For example, when $n = 3$, there are 9 rectangles, one of which is highlighted below:



5. Binomial/Multinomial theorem.

   (a) Find the coefficient of x^6 in $(2x - 1)^{12}$.

   (b) Find the coefficient of x^6 in $(2x^2 - 1)^{12}$. (Hint: use the substitution $y = x^2$.)

   (c) Find the coefficient of $x^6y^2z^3$ in $(2x - y + 3z)^{11}$.

   (d) Find the coefficient of x^5y^2 in $(x + y + 1)^{10}$.

   (e) Compute $\sum_{k=0}^{n} 2^k \binom{n}{k}$.

   (f) Compute $\sum_{k=0}^{n} \frac{1}{k!(n-k)!}$. Hint: recall the formula for $\binom{n}{k}$. Relate the given sum to one involving binomial coefficients.