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**Assignment 9**

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**Due Date:** This assignment is due in your workshop in week 11. You are also required submit it electronically through Blackboard.

1. Find the coefficient of  $x^5y^1$  in the expansion of  $\left(12xy - \frac{9}{xy^2}\right)^{13}$ .
  
2. There are 6 types of books and there are 200 identical books of each type. How many ways are there to select 10 books?
  
3. In the 3-dimensional lattice, how many ways are there to go from the origin  $(0, 0, 0)$  to the point  $(6, 2, 4)$  when in a step starting from a point  $(x, y, z)$  I can move to  $(x + 1, y, z)$ , to  $(x, y + 1, z)$  or  $(x, y, z + 1)$ ?
  
4.
  - (a) Solve the recurrence relation  $a_n = 3a_{n-1} + 10a_{n-2}$  with initial conditions  $a_0 = 4$  and  $a_1 = -1$ .
  - (b) Solve the recurrence relation  $a_n = 6a_{n-1} - 9a_{n-2}$  with initial conditions  $a_0 = 2$  and  $a_1 = 9$ .

5. Solve the recurrence relation

$$\sqrt{a_n} = \sqrt{a_{n-1}} + 2\sqrt{a_{n-2}}$$

with initial conditions  $a_0 = a_1 = 1$  by making the substitution  $b_n = \sqrt{a_n}$ .

**[Challenge Question]**

6. Use induction and Pascal's Triangle Identity (being careful at the edges) to show  $\sum_{k=0}^n \binom{n}{k} = 2^n$ . (*You will get no marks for a proof using the Binomial Theorem.*)

END OF EXAMINATION