

**CSC 226 SUMMER 2018**  
**ALGORITHMS AND DATA STRUCTURES II**  
**ASSIGNMENT 1 - WRITTEN**  
**UNIVERSITY OF VICTORIA**

1. I have seven different programming textbooks on my bookshelf, three C++ and four Java. In how many ways can I arrange the books
  - a) if there are no restrictions?
  - b) if the languages should alternate?
  - c) if all the C++ books must be next to each other?
  - d) if all the C++ books must be next to each other and all the Java books must be next to each other?

2. a) Show that if  $n$  is a positive integer and  $n > 2$ , then

$$\binom{n}{2} + \binom{n-1}{2}$$

is a perfect square (i.e. its square root is an integer.)

- b) For  $x$  a real number and  $n$  a positive integer, show that

$$1 = (1+x)^n - \binom{n}{1}x(1+x)^{n-1} + \binom{n}{2}x^2(1+x)^{n-2} - \dots + (-1)^n \binom{n}{n}x^n$$

3. Determine the number of integer solutions of  $x_1 + x_2 + x_3 + x_4 = 32$ , where
  - a)  $x_i \geq 0, 1 \leq i \leq 4$
  - b)  $x_i > 0, 1 \leq i \leq 4$
4. During the first six weeks after you graduate you send out at least one resumé a day but no more than 60 resúmes in total. Show that there is a period of consecutive days during which you send out exactly 23 resúmes.
5. Let  $(A, \mathcal{R}_1)$  and  $(B, \mathcal{R}_2)$  be two posets. Consider the set derived from the cross product of sets  $A$  and  $B$ ,  $A \times B = \{(a, b) : a \in A, b \in B\}$ . Define relation  $\mathcal{R}$  on  $A \times B$  by  $((a, b), (x, y)) \in \mathcal{R}$  if  $(a, x) \in \mathcal{R}_1$  and  $(b, y) \in \mathcal{R}_2$ . Prove that  $\mathcal{R}$  is a partial order.