SFWR ENG 2FA3: Discrete Mathematics and Logic II **Assignment 2**

Due on Friday, February 17, 2012

This assignment paper includes 2 pages and 5 questions. You are responsible for ensuring that your copy of the paper is complete. Bring any discrepancy to the attention of the instructor.

Special Instructions :

1. The burden of communication is upon you. Solutions not properly explained will not be considered correct. Part of proper communication is the appearance and layout. If we cannot "decode" what you wrote, we cannot grade it as a correct answer.
2. When the question requires you to answer only one subquestion, only the first answer will be marked if you answer more than one subquestion.
3. You are permitted to discuss *general aspects* of the problem sets with other students in the class, but each person must hand in her own copy of the solution. Any use of **any** source **must** be documented in the assignment log.
4. The assignments reports will be due **at the beginning of the lecture** on the due date.

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Question 1 [1 mark] Expand the following textual substitution.

$$*(x \mid 0 \leq x < r \;:\; *(y \mid 0 \leq y \;:\; x + y + n\,)\,)\,[n \;:=\; x + y]$$

Question 2 [1 mark] Prove that

$$\exists(x \mid:\; R\,) \implies \Big(\,(\,\exists(x \mid R \;:\; \neg P\,) \vee Q) \iff \exists(x \mid R \;:\; P \implies Q\,)\Big),$$

where x does not occur free in Q.

Question 3 [03 marks] Using the assignment axiom, determine the weakest preconditions for the following statements and postconditions. Simplify the preconditions you obtain.

1. $\{\quad ?\quad \}\; x, y \;:=\; x - y, x + y\; \{x.y = 1\}$
2. $\{\quad ?\quad \}\; x, y, z \;:=\; z, x, y\; \{x = 0 \vee y = 1 \vee z = 2\}$
3. $\{\quad ?\quad \}\; x, y \;:=\; z, x;\; z \;:=\; y\; \{x = 0 \vee y = 1 \vee z = 2\}$

Question 4 [2 marks] Write the specification of a program that takes as input an array b and a number m. It returns an array c. If m is odd, c is the reverse of b. If m is even, each cell in c is the double of its corresponding in b. The reverse of (3,2,5,5) is (5,5,2,3).

Question 5 [03 marks] The factorial function $n!$ satisfies the equations $0! = 1$ and , $\forall(n \mid n \in \mathbb{N} \;:\; (n + 1)! = (n + 1) \times n!\,)$.

Suppose program variables f and n satisfy the property $f = n!$ and it is required to maintain this property by a suitable assignment to f whilst simultaneously incrementing n by 1. Calculate the assignment.

THE END.