3) (10 pts) ANL (Summations)

Determine a closed form solution to the following summation in terms of **n**. Please leave your answer in **factored** form. Specifically, your answer should be of the form $\frac{(n+a)(n+b)(n+c)}{d}$, where a, b, c and d are all integers.

$$\sum_{i=1}^{n}\sum_{j=1}^{i} j$$

$$\sum_{i=1}^{n}\sum_{j=1}^{i} j = \sum_{i=1}^{n} \frac{i(i+1)}{2}$$

$$= \frac{1}{2}\left[\left(\sum_{i=1}^{n} i^2\right) + \left(\sum_{i=1}^{n} i\right)\right]$$

$$= \frac{1}{2}\left[\left(\frac{n(n+1)(2n+1)}{6}\right) + \left(\frac{n(n+1)}{2}\right)\right]$$

$$= \frac{1}{12}\left[\left(n(n+1)(2n+1)\right) + (3n(n+1))\right]$$

$$= \frac{n(n+1)}{12}\left[(2n+1) + 3\right]$$

$$= \frac{n(n+1)}{12}\left[2n+4\right]$$

$$= \frac{n(n+1)}{12}\left[2(n+2)\right]$$

$$= \frac{n(n+1)(n+2)}{6}$$

Grading: 1 pt inner sum, 1 pt split sum, 2 pts plug into i^2 formula, 2 pts plug into I formula
4 pts algebra (decide partial as necessary)

Computer Science Foundation Exam

January 13, 2024

Section D

ALGORITHMS

NO books, notes, or calculators may be used,
and you must work entirely on your own.

SOLUTION

Question #	Max Pts	Category	Score
1	10	DSN	
2	5	ALG	
3	10	DSN	
TOTAL	25		

You must do all 3 problems in this section of the exam.

Problems will be graded based on the completeness of the solution steps and not graded based on the answer alone. Credit cannot be given unless all work is shown and is readable. Be complete, yet concise, and above all be neat. For each coding question, assume that all of the necessary includes (stdlib, stdio, math, string) for that particular question have been made.