Course: DSPD-I (Winter-2019)

Tutorial 1

Topic: Loops

Q.1	**Write a program which reads $n > 10$ and a real variable x, $0 \leq \lvert x \rvert \leq 1$, and computes and prints the sum of the series up to n terms for the value of x read:** $\sinh^{-1}(x) = x - \frac{1}{2}\cdot\frac{x^3}{3} + \frac{1}{2}\cdot\frac{3}{4}\cdot\frac{x^5}{5} - \frac{1}{2}\cdot\frac{3}{4}\cdot\frac{5}{6}\cdot\frac{x^7}{7} + \ldots \frac{1}{2}\cdot\frac{3}{4}\cdot\frac{5}{6}\cdot\frac{2i-3}{2i-2}\cdot\frac{x^{2i-1}}{2i-1} + \ldots$ **Write the appropriate loop invariant for your program when 'k' iterations are completed. (k > 0)**
Q.2	**The inverse of sin function can be defined as:** $\sin^{-1} x = \sum_{n=0}^{\infty} \frac{\Gamma(n+\frac{1}{2})}{\sqrt{\pi}\,(2n+1)\,n!} x^{2n+1}$, **$\Gamma(x)$ is a gamma function defined as** $\Gamma(\frac{n}{2}) = \frac{(n-2)!!\sqrt{\pi}}{2^{(n-1)/2}}$ **where n!! is a double factorial. Example:** $\Gamma(\frac{1}{2}) = \sqrt{\pi}$ **and n!! =** **n. (n-2) . . . 5. 3. 1 if n is odd** **n. (n-2) . . . 6. 4. 2 if n is even** **1 if n = -1, 0** **Write a program to calculate $\sin^{-1} x$ using above definition.**
Q.3	**For a real number x, the notation ⌊x⌋ stands for the largest integer less than or equal to x. For example, ⌊3.14⌋ = 3. You are to write a program that reads a positive integer n and an integral base b ≥ 2. The program computes and prints the value of $\lfloor \log_b n \rfloor$. For example, $\log_{23} 456789 = 4.1562752022\ldots$ and so $\lfloor \log_{23} 456789 \rfloor = 4$. Therefore, upon input n = 456789 and b = 23, your program should print 4. Note: Do not use math.h library functions. Mention your loop invariant clearly.**
Q.4	**You are playing a game in which your aim is to exactly reach a particular tile in a given number of tiles (n) arranged circularly. Rule also states that the steps you take have to follow the series 1, 2, 4, 8, … in anticlockwise direction. Given the number of tiles arranged and the position(d) of the destination tile (in the anticlockwise direction) from start (starting tile is numbered 0), output the least number of**

	steps taken to reach the destination. Assume that the input is such that the given destination tile is guaranteed to be reached. Also, write the loop invariant for your program. **Illustration:** **1. n = 6, d = 3, output = 2;** **Numbers 0, 1, 2, 3, 4, 5 will be arranged in a circular fashion and 3 can be reached from 0 in 2 steps (0-1-3)** **2. n = 11, d = 8, output = 6;** **Numbers 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10 will be arranged in a circular fashion and 8 can be reached from 0 in 6 steps (0-1-3-7-4-9-8)**
Q.5	**Find the relation of the following numbers and identify the incorrect number in the series. Replace it by the correct number and write a function for the series:** **4, 6, 12, 30, 90, 312.5, 1260**
Q.6	**Generate the first n terms of the following sequence without using multiplication:** **1, 2, 4, 8, 16, 32…..**
Q.7	**Write a program to print sum of series for 'n' terms** **1 + (1 + 3) + (1 + 3 + 5) + (1 + 3 + 5 + 7) + . . .**
Q.8	**Read the value of 'x' & 'n'. Write a program to evaluate following series** **x + (x - 1) / 3 + (x - 2) / 5 + . . . +(x - n) / (2n - 1)**