AI4ICPS IIT Kharagpur	**IIT KHARAGPUR AI4ICPS I HUB FOUNDATION** **H**ands-on **A**pproach to **AI, Cohort-4, November 2025 – January 2026** **Programming Assignment 1**

Important Instructions for submitting solutions

1. Programming assignments will be evaluated automatically. Do not change the skeleton code provided to you.
2. Do not modify the skeleton code structure or import additional libraries.
3. Implement only inside the designated series() and frac() functions.
4. The program will receive ip as a command-line argument.

Objective: Write a Python program that computes the following alternating factorial series for a given integer input *ip*:

$$S = \sum_{k=1}^{ip} (-1)^{k+1} \cdot \frac{frac(k)^2}{k! + k}$$

where *frac*(*k*) represents the factorial of *k*, i.e., *frac*(*k*) = *k*!.

Special Rules:

- If the input *ip* < 0, the program must return 999.0.
- The final result must be rounded to two decimal places.

Example Calculation: For *ip* = 3:

$$S = \frac{frac(1)^2}{1! + 1} - \frac{frac(2)^2}{2! + 2} + \frac{frac(3)^2}{3! + 3}$$

$$S = \frac{1}{2} - \frac{4}{4} + \frac{36}{9} = 0.5 - 1 + 4 = 3.5$$

Thus, the output should be 3.50.

Skeleton

```
# ======================================================
# IIT KHARAGPUR AI4ICPS HUB FOUNDATION
# Hands-on Approach to AI, Cohort-4, November 2025
# Programming Assignment 1
# ======================================================

import sys

# ------------------------------------------------------
# Function: frac
```

```
# Description: Computes the factorial of a number recursively.
# You are allowed to edit inside this function only.
# ------------------------------------------------------------
def frac(n):
    # TODO: Implement the recursive factorial function
    pass

# ------------------------------------------------------------
# Function: series
# Description: Computes the alternating factorial series
# S = Σ (-1)^(k+1) * (frac(k)^2) / (frac(k) + k)
# ------------------------------------------------------------
def series(ip):
    # TODO: Implement the logic for computing the series
    pass

# ------------------------------------------------------------
# Main function: DO NOT MODIFY
# ------------------------------------------------------------
if __name__ == "__main__":
    ip = int(sys.argv[1])
    print(series(ip))
```

Sample Test Cases (JSON Format)

```
[      {"input": 1, "expected_output":  0.50},

     {"input":  2,  "expected_output":  -0.50},

     {"input":  3,  "expected_output":  3.50},

     {"input":  4,  "expected_output":  -6.67},

     {"input":  5,  "expected_output":  96.00}

]
```