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#Question:1
# Calculation of total Infiltration by Horton's Equation

# Given Data
fo = float(input("Enter the value of initial Infiltration Rate (fo): "))  # Initial infil
fc = float(input("Enter the value of final infiltration rate (fc): "))  # Final infiltrat
t = float(input("Enter the value of time (t): "))  # Time
kh = float(input("Enter the value of decay coefficient (kh): "))  # Decay coefficient

# Horton's Equation for total infiltration
Fp = fc * t + (fo - fc) / kh  # Corrected the formula and fixed the string quote error
print("The value of Total Infiltration (Fp) is:", Fp)
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Enter the value of initial Infiltration Rate (fo): 6
Enter the value of final infiltration rate (fc): 1.2
Enter the value of time (t): 8
Enter the value of decay coefficient (kh): 0.888
The value of Total Infiltration (Fp) is: 15.005405405405405
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#Question:2
# Calculation of Mean Precipitation by Thiessen's Polygon Method

# The value of precipitation at each station
p1 = int(input("Enter the value of rainfall at Station 1 (p1): "))  # Rainfall at Station
p2 = int(input("Enter the value of rainfall at Station 2 (p2): "))  # Rainfall at Station
p3 = int(input("Enter the value of rainfall at Station 3 (p3): "))  # Rainfall at Station
p4 = int(input("Enter the value of rainfall at Station 4 (p4): "))  # Rainfall at Station
p5 = int(input("Enter the value of rainfall at Station 5 (p5): "))  # Rainfall at Station

# Area for each station
A1 = int(input("Enter the value of Catchment Area for Raingauge Station 1 (A1): "))  # Ar
A2 = int(input("Enter the value of Catchment Area for Raingauge Station 2 (A2): "))  # Ar
A3 = int(input("Enter the value of Catchment Area for Raingauge Station 3 (A3): "))  # Ar
A4 = int(input("Enter the value of Catchment Area for Raingauge Station 4 (A4): "))  # Ar
A5 = int(input("Enter the value of Catchment Area for Raingauge Station 5 (A5): "))  # Ar

# Total catchment area
A = A1 + A2 + A3 + A4 + A5
print("The value of Total Catchment Area is:", A)

# Runoff Volume
# The volume is multiplied by 2500 to cater to scale effects
V = (p1 * A1 + p2 * A2 + p3 * A3 + p4 * A4 + p5 * A5) * 2500
print("The runoff volume from the given catchment is:", V)

# Mean Precipitation
P = (p1 * A1 + p2 * A2 + p3 * A3 + p4 * A4 + p5 * A5) / A
print("The value of Mean Precipitation is:", P)
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Enter the value of rainfall at Station 1 (p1): 125
Enter the value of rainfall at Station 2 (p2): 175
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Enter the value of rainfall at Station 3 (p3): 225
Enter the value of rainfall at Station 4 (p4): 275
Enter the value of rainfall at Station 5 (p5): 325
Enter the value of Catchment Area for Raingauge Station 1 (A1): 25
Enter the value of Catchment Area for Raingauge Station 2 (A2): 30
Enter the value of Catchment Area for Raingauge Station 3 (A3): 30
Enter the value of Catchment Area for Raingauge Station 4 (A4): 10
Enter the value of Catchment Area for Raingauge Station 5 (A5): 5
The value of Total Catchment Area is: 100
The runoff volume from the given catchment is: 48750000
The value of Mean Precipitation is: 195.0
```

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#Question:3
# Calculation of Mean Precipitation by Isohyetal Method

# The value of precipitation at each station
p1 = int(input("Enter the value of rainfall at Station 1 (p1): "))  # Rainfall at Station
p2 = int(input("Enter the value of rainfall at Station 2 (p2): "))  # Rainfall at Station
p3 = int(input("Enter the value of rainfall at Station 3 (p3): "))  # Rainfall at Station
p4 = int(input("Enter the value of rainfall at Station 4 (p4): "))  # Rainfall at Station
p5 = int(input("Enter the value of rainfall at Station 5 (p5): "))  # Rainfall at Station
p6 = int(input("Enter the value of rainfall at Station 6 (p6): "))  # Rainfall at Station
p7 = int(input("Enter the value of rainfall at Station 7 (p7): "))  # Rainfall at Station
p8 = int(input("Enter the value of rainfall at Station 8 (p8): "))  # Rainfall at Station

# Area for each station
A1 = int(input("Enter the value of Catchment Area for Raingauge Station 1 (A1): "))  # Ar
A2 = int(input("Enter the value of Catchment Area for Raingauge Station 2 (A2): "))  # Ar
A3 = int(input("Enter the value of Catchment Area for Raingauge Station 3 (A3): "))  # Ar
A4 = int(input("Enter the value of Catchment Area for Raingauge Station 4 (A4): "))  # Ar
A5 = int(input("Enter the value of Catchment Area for Raingauge Station 5 (A5): "))  # Ar
A6 = int(input("Enter the value of Catchment Area for Raingauge Station 6 (A6): "))  # Ar
A7 = int(input("Enter the value of Catchment Area for Raingauge Station 7 (A7): "))  # Ar

# Total catchment area
A = A1 + A2 + A3 + A4 + A5 + A6 + A7
print("The value of Total Catchment Area is:", A)

# Mean Precipitation using Isohyetal Method
P = (
    ((p1 + p2) * A1 / 2) +
    ((p2 + p3) * A2 / 2) +
    ((p3 + p4) * A3 / 2) +
    ((p4 + p5) * A4 / 2) +
    ((p5 + p6) * A5 / 2) +
    ((p6 + p7) * A6 / 2) +
    ((p7 + p8) * A7 / 2)
) / A

print("The value of Mean Precipitation is:", P)
```

```
Enter the value of rainfall at Station 1 (p1): 14
Enter the value of rainfall at Station 2 (p2): 12
Enter the value of rainfall at Station 3 (p3): 10
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Enter the value of rainfall at Station 4 (p4): 8
Enter the value of rainfall at Station 5 (p5): 6
Enter the value of rainfall at Station 6 (p6): 4
Enter the value of rainfall at Station 7 (p7): 2
Enter the value of rainfall at Station 8 (p8): 0
Enter the value of Catchment Area for Raingauge Station 1 (A1): 90
Enter the value of Catchment Area for Raingauge Station 2 (A2): 140
Enter the value of Catchment Area for Raingauge Station 3 (A3): 125
Enter the value of Catchment Area for Raingauge Station 4 (A4): 140
Enter the value of Catchment Area for Raingauge Station 5 (A5): 85
Enter the value of Catchment Area for Raingauge Station 6 (A6): 40
Enter the value of Catchment Area for Raingauge Station 7 (A7): 20
The value of Total Catchment Area is: 640
The value of Mean Precipitation is: 8.40625
```

```
import numpy as np

N = int(input("Number of data values of rainfall: "))
M = int(input("Number of data values of Area: "))

R = []  # List for rainfall data
A = []  # List for area data

# Input data for rainfall
for i in range(N):
    rainfall = float(input(f"Enter rainfall value {i+1}: "))
    R.append(rainfall)

# Input data for area
for j in range(M):
    area = float(input(f"Enter area value {j+1}: "))
    A.append(area)

# Convert lists to NumPy arrays
R = np.array(R)
A = np.array(A)

# Calculate the dot product
product = np.dot(R, A)

# Calculate the mean precipitation
mean_precipitation = product / np.sum(A)

print("Mean Precipitation:", mean_precipitation, "cm")
3
```

```
Number of data values of rainfall: 5
Number of data values of Area: 5
Enter rainfall value 1: 125
Enter rainfall value 2: 175
Enter rainfall value 3: 225
Enter rainfall value 4: 275
Enter rainfall value 5: 325
Enter area value 1: 25
Enter area value 2: 30
Enter area value 3: 30
```

```
Enter area value 4: 10
Enter area value 5: 5
Mean Precipitation: 195.0 cm
```

```
import numpy as np

N = int(input("Number of pulses: "))
dt = float(input("Enter time interval of each pulse in hours: "))
Rd = float(input("Enter the value of runoff depth (Rd) in cm: "))

Ri = []  # Rainfall intensity

for i in range(1, N + 1):
    value = float(input(f"Enter rainfall intensity in cm/hr for pulse {i}: "))
    Ri.append(value)

# W-Index calculation
Total_Rain = sum(Ri) * dt
print("Total depth of rainfall = {:.2f} cm".format(Total_Rain))

W_index = (Total_Rain - Rd) / (N * dt)
print("W-index = {:.2f} cm/hr".format(W_index))

# Phi-Index Calculation
def excess_rain(M, Ri, tr):
    print("Trial No:", tr)
    print(f"Assume that out of {N} pulses, {M} pulses have rainfall excess")
    te = dt * M  # duration of excess rainfall
    print("Duration of excess rainfall = {:.2f} hrs".format(te))

    R_depth = 0
    for j in range(M):
        R_depth += Ri[j] * dt

    print("Total depth of excess rainfall for trial", tr, "=", R_depth, "cm")

    phi = (R_depth - Rd) / te
    print("Phi Index for trial", tr, "=", phi, "cm/hr")

    Ri.sort()
    print("Ri (sorted) = ", Ri)
    return phi

M = N
tr = 1  # trial number

while 0 < M <= N:
    phi = excess_rain(M, Ri, tr)  # driver function
    print("While loop Ri =", Ri)
    print("While loop Phi =", phi)

    M -= 1
    tr+=15
    if Ri and Ri[0] > phi:
        print("\nFinal value of Phi-index = {:.2f} cm/hr".format(phi))
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            break
        else:
            if Ri:
                print("As rainfall intensity ({:.2f} cm/hr) < 0, so no contribution tow
                del Ri[0]
                print("Assumption of {} pulses have rainfall excess fails, so remove le
                print("Excess rainfall intensities (sorted):", Ri)
                print("In next trial assume no. of pulses that have rainfall excess:",

    # Final output of remaining excess rainfall intensities
    if Ri:
        print("Remaining excess rainfall intensities:", Ri)
    0
```

```
Number of pulses: 8
Enter time interval of each pulse in hours: 2
Enter the value of runoff depth (Rd) in cm: 5.8
Enter rainfall intensity in cm/hr for pulse 1: 0.2
Enter rainfall intensity in cm/hr for pulse 2: 0.45
Enter rainfall intensity in cm/hr for pulse 3: .75
Enter rainfall intensity in cm/hr for pulse 4: 1.15
Enter rainfall intensity in cm/hr for pulse 5: 0.9
Enter rainfall intensity in cm/hr for pulse 6: 0.8
Enter rainfall intensity in cm/hr for pulse 7: 0.5
Enter rainfall intensity in cm/hr for pulse 8: 0.25
Total depth of rainfall = 10.00 cm
W-index = 0.26 cm/hr
Trial No: 1
Assume that out of 8 pulses, 8 pulses have rainfall excess
Duration of excess rainfall = 16.00 hrs
Total depth of excess rainfall for trial 1 = 10.0 cm
Phi Index for trial 1 = 0.2625 cm/hr
Ri (sorted) =  [0.2, 0.25, 0.45, 0.5, 0.75, 0.8, 0.9, 1.15]
While loop Ri = [0.2, 0.25, 0.45, 0.5, 0.75, 0.8, 0.9, 1.15]
While loop Phi = 0.2625
As rainfall intensity (0.20 cm/hr) < 0, so no contribution towards runoff
Assumption of 7 pulses have rainfall excess fails, so remove least rainfall intensity
Excess rainfall intensities (sorted): [0.25, 0.45, 0.5, 0.75, 0.8, 0.9, 1.15]
In next trial assume no. of pulses that have rainfall excess: 7
Trial No: 2
Assume that out of 8 pulses, 7 pulses have rainfall excess
Duration of excess rainfall = 14.00 hrs
Total depth of excess rainfall for trial 2 = 9.6 cm
Phi Index for trial 2 = 0.2714285714285714 cm/hr
Ri (sorted) =  [0.25, 0.45, 0.5, 0.75, 0.8, 0.9, 1.15]
While loop Ri = [0.25, 0.45, 0.5, 0.75, 0.8, 0.9, 1.15]
While loop Phi = 0.2714285714285714
As rainfall intensity (0.25 cm/hr) < 0, so no contribution towards runoff
Assumption of 6 pulses have rainfall excess fails, so remove least rainfall intensity
Excess rainfall intensities (sorted): [0.45, 0.5, 0.75, 0.8, 0.9, 1.15]
In next trial assume no. of pulses that have rainfall excess: 6
Trial No: 3
Assume that out of 8 pulses, 6 pulses have rainfall excess
Duration of excess rainfall = 12.00 hrs
Total depth of excess rainfall for trial 3 = 9.1 cm
Phi Index for trial 3 = 0.27499999999999997 cm/hr
Ri (sorted) =  [0.45, 0.5, 0.75, 0.8, 0.9, 1.15]
While loop Ri = [0.45, 0.5, 0.75, 0.8, 0.9, 1.15]
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```
While loop Phi = 0.27499999999999997

Final value of Phi-index = 0.27 cm/hr
Remaining excess rainfall intensities: [0.45, 0.5, 0.75, 0.8, 0.9, 1.15]
0
```