EXPERIMENT NO. 1

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SUBJECT : DAA (LAB)
SY BTECH COMPUTER ENGINEERING

AIM: Understanding the process of calculating SPI (Semester Performance Index) and CPI (Cumulative Performance Index). Design the algorithm and develop the program for the same.

THEORY : SPI stands for **Semester Performance Index**, which is a measure used by many universities and colleges to evaluate the academic performance of a student in a particular semester. It is similar to the **GPA (Grade Point Average)** but specifically focuses on a student's performance within a single semester.
The grades are typically assigned on a scale (such as 10-point or 4-point), and each grade corresponds to certain grade points. These grade points are multiplied by the credits assigned to each course, and the total is divided by the sum of the credits.

SPI Formula:

$$SPI = \frac{c1g1+c2g2+c3g3+c4g4+c5g5}{c1+c2+c3+c4+c5}$$

CPI (Cumulative Performance Index): The CPI is the weighted average of the Grade Points a student has earned in all subjects (courses) up to the current semester. It reflects a student's performance across all semesters, taking into account the grades achieved and the credit weightage of each subject.
An up to date assessment of the overall performance of a student from the time she/he entered the Institute is obtained by calculating a number called the Cumulative Performance Index, CPI, in a manner similar to the calculation of SPI. The CPI therefore considers all the courses registered by the student, towards the minimum requirement of the degree she/he has enrolled for, since she/he entered the Institute.

CPI Formula:

CPI= ∑(Grade Points×Credits) / ∑(Total Credits)

Grading Scheme :

Grading Scheme		
Letter Grade	Grade Points	Indicative degree of mastery
AA	10.0	Outstanding
AB	9.0	Excellent
BB	8.0	Very good
BC	7.0	Good
CC	6.0	Satisfactory
CD	5.0	Average
DD	4.0	Marginal
FF	0.0	Very weak

Example TEST CASE :

Sem 1 :

Course	Grade	Grade Points	Credits
Course 1	AA	10	3
Course 2	AB	9	4
Course 3	BB	8	3
Course 4	AB	9	2
Course 5	AA	10	4

SPI= (3×10)+(4×9)+(3×8)+(2×9)+(4×10) / 3+4+3+2+4
SPI = 148/16 = 9.25

Sem 2 :

Course	Grade	Grade Points	Credits
Course 1	AA	10	4
Course 2	AB	9	3
Course 3	BB	8	2

SPI 2 : (4×10)+(3×9)+(2×8) / 4+3+2
SPI 2 = 83/9 = 9.22

SEM 3 :

Course	Grade	Grade Points	Credits
Course 1	AB	9	3
Course 2	BB	8	3
Course 3	AB	9	3

SPI= (3×9)+(3×8)+(3×9) / 3+3+3
SPI = 78/9 = 8.67

SEM 4 :

Course	Grade	Grade Points	Credits
Course 1	AA	10	4
Course 2	AB	9	4

SPI= (4×10)+(4×9) /4+4
SPI = 76/8 = 9.50

SEM 5 :

Course	Grade	Grade Points	Credits
Course 1	AA	10	5

SPI=(5×10) / 5
SPI = 50/5 = 10

Summary of SPI for Each Semester

Semester	SPI
Semester 1	9.25
Semester 2	9.22
Semester 3	8.67
Semester 4	9.50
Semester 5	10.00

CPI :

FORMULA : CPI= ∑(Grade Points×Credits) / ∑(Total Credits)

(9.25×16)+(9.22×9)+(8.67×9)+(9.50×8)+(10.00×5) / 16+9+9+8+5

CPI : 435.01 /47 = 9.25

ALGORITHM AND PSEUDOCODE FOR CALCULATING SPI AND CPI

Algorithm SPI & CPI CALCULATION

```
// Step 1: Initialize variables
Declare Integer semesters ← 5
Declare Array SPI[semesters]
Declare Real total_weighted_points ← 0
Declare Real total_credits ← 0

// Step 2: Calculate SPI for each semester
For i from 0 to semesters - 1 do
    Declare Real semester_weighted_points ← 0
    Declare Integer semester_credits ← 0
    Input "Enter the number of courses for Semester", i + 1, num_courses

    // Input credits and grade points for each course
    For j from 0 to num_courses - 1 do
        Input credits, grade_points
        semester_weighted_points += credits * grade_points
        semester_credits += credits
        total_weighted_points += credits * grade_points
        total_credits += credits
    End For
```

// Calculate SPI for the semester

SPI[i] ← (semester_credits > 0) ? (semester_weighted_points / semester_credits) : 0

End For

// Calculate CPI

cpi ← (total_credits > 0) ? (total_weighted_points / total_credits) : 0

// Output results

Print "SPI for each semester:", SPI

Print "Cumulative Performance Index (CPI):", cpi

End Algorithm

CODE :

```
def calculate_spi_and_cpi():
    # Initialize variables
    semesters = 5
    spi = [0] * semesters  # Array to store SPI for each semester
    total_weighted_points = 0  # Variable to accumulate weighted points for
CPI
    total_credits = 0  # Variable to accumulate total credits for CPI

    # Step 1: Calculate SPI for each semester
    for i in range(semesters):
        semester_weighted_points = 0
        semester_credits = 0

        # Input number of courses for the semester
        num_courses = int(input(f"Enter the number of courses for Semester {i
+ 1}: "))

        # Step 2: Input credits and grade points for each course in the
semester
        for j in range(num_courses):
            credits = float(input(f"Enter credits for course {j + 1} in
Semester {i + 1}: "))
            grade_points = float(input(f"Enter grade points for course {j + 1}
in Semester {i + 1}: "))

            # Calculate weighted points for semester
            semester_weighted_points += credits * grade_points
```

```
            semester_credits += credits

            # Accumulate for CPI calculation
            total_weighted_points += credits * grade_points
            total_credits += credits

        # Step 3: Calculate SPI for the semester
        if semester_credits > 0:
            spi[i] = semester_weighted_points / semester_credits
        else:
            spi[i] = 0  # Handle case of zero credits

    # Step 4: Calculate CPI
    if total_credits > 0:
        cpi = total_weighted_points / total_credits
    else:
        cpi = 0  # Handle case of zero total credits

    # Step 5: Output results
    print("\nSPI for each semester:")
    for i in range(semesters):
        print(f"Semester {i + 1}: {spi[i]:.2f}")

    print(f"\nCumulative Performance Index (CPI): {cpi:.2f}")

# Call the function to run the program
calculate_spi_and_cpi()
```

OUTPUT :

```
PS C:\Users\adity\OneDrive\Desktop\DAA lab> & "c:/Users/adity/OneDrive/Desktop/DAA lab/.venv/Scripts/python.exe"
Users/adity/OneDrive/Desktop/DAA lab/.venv/spi_cpi.py"
Enter the number of courses for Semester 1: 5
Enter credits for course 1 in Semester 1: 3
Enter grade points for course 1 in Semester 1: 10
Enter credits for course 2 in Semester 1: 4
Enter grade points for course 2 in Semester 1: 9
Enter credits for course 3 in Semester 1: 3
Enter grade points for course 3 in Semester 1: 8
Enter credits for course 4 in Semester 1: 2
Enter grade points for course 4 in Semester 1: 9
Enter credits for course 5 in Semester 1: 4
Enter grade points for course 5 in Semester 1: 10
Enter the number of courses for Semester 2: 3
Enter credits for course 1 in Semester 2: 4
Enter grade points for course 1 in Semester 2: 10
Enter credits for course 2 in Semester 2: 3
Enter grade points for course 2 in Semester 2: 9
Enter credits for course 3 in Semester 2: 2
Enter grade points for course 3 in Semester 2: 8
Enter the number of courses for Semester 3: 3
Enter credits for course 1 in Semester 3: 3
Enter grade points for course 1 in Semester 3: 9
Enter credits for course 2 in Semester 3: 3
Enter grade points for course 2 in Semester 3: 8
Enter credits for course 3 in Semester 3: 3
Enter grade points for course 3 in Semester 3: 9
Enter the number of courses for Semester 4: 2
Enter credits for course 1 in Semester 4: 4
Enter grade points for course 1 in Semester 4: 10
Enter credits for course 2 in Semester 4: 4
Enter grade points for course 2 in Semester 4: 9
Enter the number of courses for Semester 5: 1
Enter credits for course 1 in Semester 5: 5
Enter grade points for course 1 in Semester 5: 10
SPI for each semester:
Semester 1: 9.25
Semester 2: 9.22
Semester 3: 8.67
Semester 4: 9.50
Semester 5: 10.00

Cumulative Performance Index (CPI): 9.26
```

Conclusion : Hence we have learnt how to calculate SPI & CPI .