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## **DESIGN ANALYSIS OF ALGORITHM**

**Theory :** Semester Performance Index (SPI) The performance of a student in a semester is indicated by a number called Semester Performance Index, SPI. The SPI is the weighted average of the grade points obtained in all the courses registered by the student during the semester. For example, if a student appears for five courses (Theory/labs/Projects/ etc.) in a semester with credits c1, c2, c3, c4 and c5 and her/his grade points in these courses are g1, g2, g3, g4 and g5 respectively, then her/his SPI is equal to:

$$SPI = \frac{\sum_{i=1}^n c_i \sum_{i=1}^n (c_i \times g_i)}{\sum_{i=1}^n c_i}$$

Cumulative Performance Index (CPI) 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. The CPI is calculated at the end of every semester to two decimal places and is indicated in semester grade reports.

$$CPI = \frac{\text{Total Credits}}{\text{Total Weighted SPI}}$$

## Test Cases for Finding CPI :

```
Enter the number of semesters: 3
Enter the SPI values: 8 7.5 9
CPI = 8.17
Enter the number of semesters: 4
Enter the SPI values: 6.2 7 7.5 8
CPI = 7.17
Enter the number of semesters: 5
Enter the SPI values: 9 8.5 8.8 9.2 8.9
CPI = 8.88
Enter the number of semesters: 2
Enter the SPI values: 6.5 7
CPI = 6.75
Enter the number of semesters: 3
Enter the SPI values: 6.4 7 7.5
CPI = 6.97
Enter the number of semesters: 0
Number of semesters must be a positive integer.
Enter the number of semesters: 1
Enter the SPI values: 5
CPI = 5.00
Enter the number of semesters:
```

## Test Cases for Finding SPI :

```
Enter the number of subjects: 3
Enter the credits for each subject: 3 4 3
Enter the grades for each subject: 8 7 9
The SPI is: 7.9
Enter the number of subjects: 3
Enter the credits for each subject: 2 2 2
Enter the grades for each subject: 6 6 6
The SPI is: 6
Enter the number of subjects: 3
Enter the credits for each subject: 1 2 3
Enter the grades for each subject: 5 5 5
The SPI is: 5
Enter the number of subjects: 4
Enter the credits for each subject: 9
5 4 3
Enter the grades for each subject: 7 8 6 5
The SPI is: 6.7619
Enter the number of subjects: 1
Enter the credits for each subject: 4
Enter the grades for each subject: 9
The SPI is: 9
Enter the number of subjects: 0
Invalid input: number of subjects must be positive.
```

## CONCLUSION :

- SPI provides a semester-wise performance measure based on the weighted average of grades.
- CPI aggregates SPI values across all semesters, considering the total credits for each semester to give an overall performance index.
- Algorithm Efficiency: Both SPI and CPI calculations are linear in time complexity relative to the number of courses and semesters, making them efficient for practical use.
- Error Handling: Ensure proper handling of edge cases like zero credits or invalid inputs to avoid errors in calculations.