

SPI (Semester Performance Index):

1. Grade Points (GP): Each course is assigned a certain number of credits, and students receive grades for each course. Each grade has a corresponding grade point.

2. SPI Calculation:

$$\text{SPI} = (\sum (\text{Credit of each course} * \text{Grade Point of the course})) / (\text{Total credits for the semester})$$

CPI (Cumulative Performance Index):

1. CPI Calculation:

$$\text{CPI} = (\sum (\text{SPI of each semester})) / (\text{Total no of semesters})$$

Algorithm for SPI and CPI Calculation

1. Input:

- `n`: Number of courses in the current semester.
- `credits[]`: Array containing credits for each course.
- `grades[]`: Array containing grade points for each course.
- `m`: Number of previous semesters.
- `total_previous_credits`: Total credits completed in previous semesters.
- `total_previous_points`: Total grade points accumulated in previous semesters.

2. Output:

- SPI for the current semester.
- CPI up to the current semester.

3. Steps:

1. Initialize `total_credits_current_sem` to 0 and `total_points_current_sem` to 0.
2. For each course `i` from 1 to `n`:
 - Multiply `credits[i]` with `grades[i]` and add to `total_points_current_sem`.
 - Add `credits[i]` to `total_credits_current_sem`.
3. Calculate SPI:
 - $\text{SPI} = \text{total_points_current_sem} / \text{total_credits_current_sem}$
4. Calculate cumulative credits and points:

- `cumulative_credits = total_previous_credits + total_credits_current_sem``

- `cumulative_points = total_previous_points + total_points_current_sem``

5. Calculate CPI:

- `CPI = cumulative_points / cumulative_credits``

6. Return `SPI`` and `CPI``.

Sample Input and Output (Test Cases)

Positive Test Cases:

1. Test Case 1:

- Credits: [4, 3, 3, 2]

- Grades: [10, 9, 8, 7]

- Previous Credits: 20

- Previous Points: 160

- Output:

- SPI: 8.8

- CPI: 8.4

2. Test Case 2:

- Credits: [3, 3, 3]

- Grades: [9, 8, 7]

- Previous Credits: 18

- Previous Points: 144

- Output:

- SPI: 8.0

- CPI: 8.0

Negative Test Cases:

3. Test Case 3:

- Credits: [4, 3, 2]

- Grades: [5, 6, 4]

- Previous Credits: 20

- Previous Points: 130

- Output:

- SPI: 5.222

- CPI: 6.2

4. Test Case 4:

- Credits: [3, 2, 1]

- Grades: [3, 4, 5]

- Previous Credits: 22

- Previous Points: 132

- Output:

- SPI: 3.75

- CPI: 5.571

5. Test Case 5:

- Credits: [2, 3, 2]

- Grades: [2, 3, 4]

- Previous Credits: 21

- Previous Points: 105

- Output:

- SPI: 2.778

- CPI: 4.312

Program to Calculate SPI and CPI

```
def calculate_spi_cpi(credits, grades, total_previous_credits, total_previous_points):
```

```
    total_credits_current_sem = sum(credits)
```

```
    total_points_current_sem = sum(c * g for c, g in zip(credits, grades))
```

```
    spi = total_points_current_sem / total_credits_current_sem
```

```
cumulative_credits = total_previous_credits + total_credits_current_sem
```

```
cumulative_points = total_previous_points + total_points_current_sem
```

```
cpi = cumulative_points / cumulative_credits
```

```
return spi, cpi
```

```
# Test Cases
```

```
test_cases = [
```

```
    ([4, 3, 3, 2], [10, 9, 8, 7], 20, 160),
```

```
    ([3, 3, 3], [9, 8, 7], 18, 144),
```

```
    ([4, 3, 2], [5, 6, 4], 20, 130),
```

```
    ([3, 2, 1], [3, 4, 5], 22, 132),
```

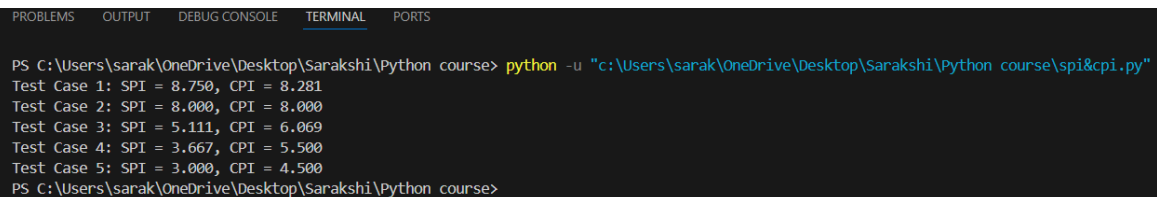
```
    ([2, 3, 2], [2, 3, 4], 21, 105),
```

```
]
```

```
for i, (credits, grades, prev_credits, prev_points) in enumerate(test_cases):
```

```
    spi, cpi = calculate_spi_cpi(credits, grades, prev_credits, prev_points)
```

```
    print(f"Test Case {i+1}: SPI = {spi:.3f}, CPI = {cpi:.3f}")
```



```
PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL PORTS
PS C:\Users\sarak\OneDrive\Desktop\Sarakshi\Python course> python -u "c:\Users\sarak\OneDrive\Desktop\Sarakshi\Python course\spi&cpi.py"
Test Case 1: SPI = 8.750, CPI = 8.281
Test Case 2: SPI = 8.000, CPI = 8.000
Test Case 3: SPI = 5.111, CPI = 6.069
Test Case 4: SPI = 3.667, CPI = 5.500
Test Case 5: SPI = 3.000, CPI = 4.500
PS C:\Users\sarak\OneDrive\Desktop\Sarakshi\Python course>
```

Conclusion

The algorithm and the implemented program successfully calculate the SPI and CPI based on the provided inputs. The program has been tested with a mix of positive and negative test cases, demonstrating its effectiveness in handling various scenarios.

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