Batch:A3 **Experiment Number: 6**

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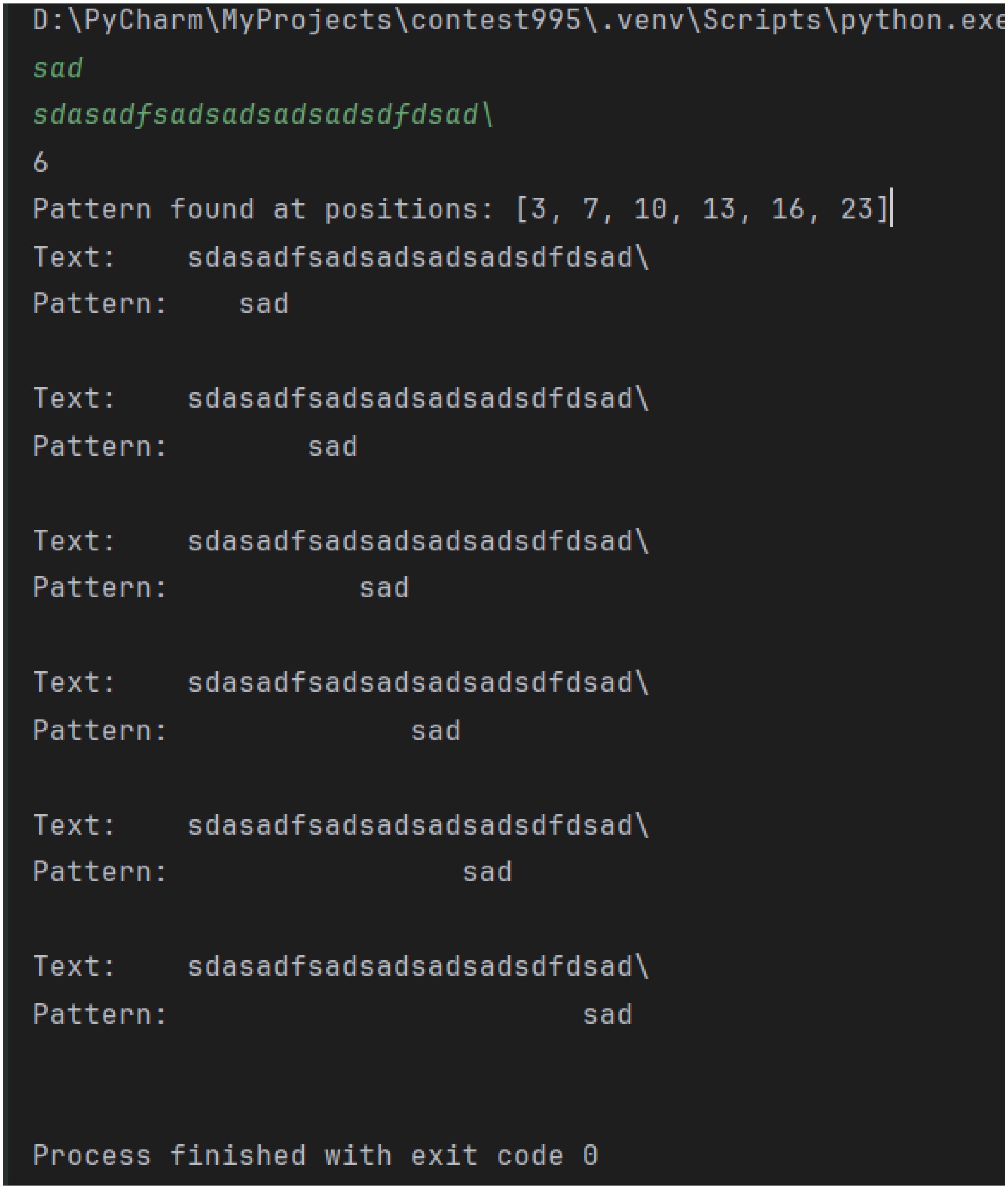
Aim of the Experiment: To study implement KMP Algorithm

Program/ Steps:

```
def compute_lps_array(pattern):
    m = len(pattern)
    lps = [0] * m

    length = 0
    i = 1

    while i < m:
        if pattern[i] == pattern[length]:
            length += 1
            lps[i] = length
            i += 1
        else:
            if length != 0:
                length = lps[length - 1]
            else:
                lps[i] = 0
                i += 1

    return lps
```

```
def kmp_search(pattern, text):
    if not pattern or not text:
        return 0

    count = 0
    found_positions = []  # Store positions where pattern is found

    m = len(pattern)
    n = len(text)

    lps = compute_lps_array(pattern)

    i = 0  # text position
    j = 0  # pattern position

    while i < n:
        # Characters match
        if pattern[j] == text[i]:
            i += 1
            j += 1

        # Pattern found
        if j == m:
            position = i - j  # Calculate where pattern starts
            found_positions.append(position)
            count += 1
            j = lps[j - 1]

        # Mismatch after j matches
        elif i < n and pattern[j] != text[i]:
            if j != 0:
                j = lps[j - 1]
            else:
                i += 1

    return count, found_positions



def main():
    # Read input
    pattern = input().strip()
    text = input().strip()

    # Find occurrences using KMP
    count, positions = kmp_search(pattern, text)

    # Print total count
    print(count)

    # Print where patterns were found
    if count > 0:
        print(f"Pattern found at positions: {positions}")
        # Show visual representation
        for pos in positions:
            print(f"Text:    {text}")
            print(f"Pattern: {' ' * pos}{pattern}")
            print()


if __name__ == "__main__":
    main()
```

Output/Result:



```
D:\PyCharm\MyProjects\contest995\.venv\Scripts\python.exe
sad
sdasadfsadsadsadsadsdfdsad\
6
Pattern found at positions: [3, 7, 10, 13, 16, 23]
Text:    sdasadfsadsadsadsadsdfdsad\
Pattern:    sad

Text:    sdasadfsadsadsadsadsdfdsad\
Pattern:        sad

Text:    sdasadfsadsadsadsadsdfdsad\
Pattern:           sad

Text:    sdasadfsadsadsadsadsdfdsad\
Pattern:              sad

Text:    sdasadfsadsadsadsadsdfdsad\
Pattern:                 sad

Text:    sdasadfsadsadsadsadsdfdsad\
Pattern:                        sad


Process finished with exit code 0
```

Post Lab Question-Answers:

None.

Outcomes:

Understand the Graphs, related algorithms, efficient implementation of those algorithms and applications.

Conclusion (based on the Results and outcomes achieved):

Successfully implemented KMP algorithm to find occurrences of string substring.

References:

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5. Steven S. Skiena Miguel A. Revilla,”Programming challenges, The Programming Contest Training Manual”, Springer, 2006
6. Antti Laaksonen, “Competitive Programmer’s Handbook”, Hand book, 2018
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