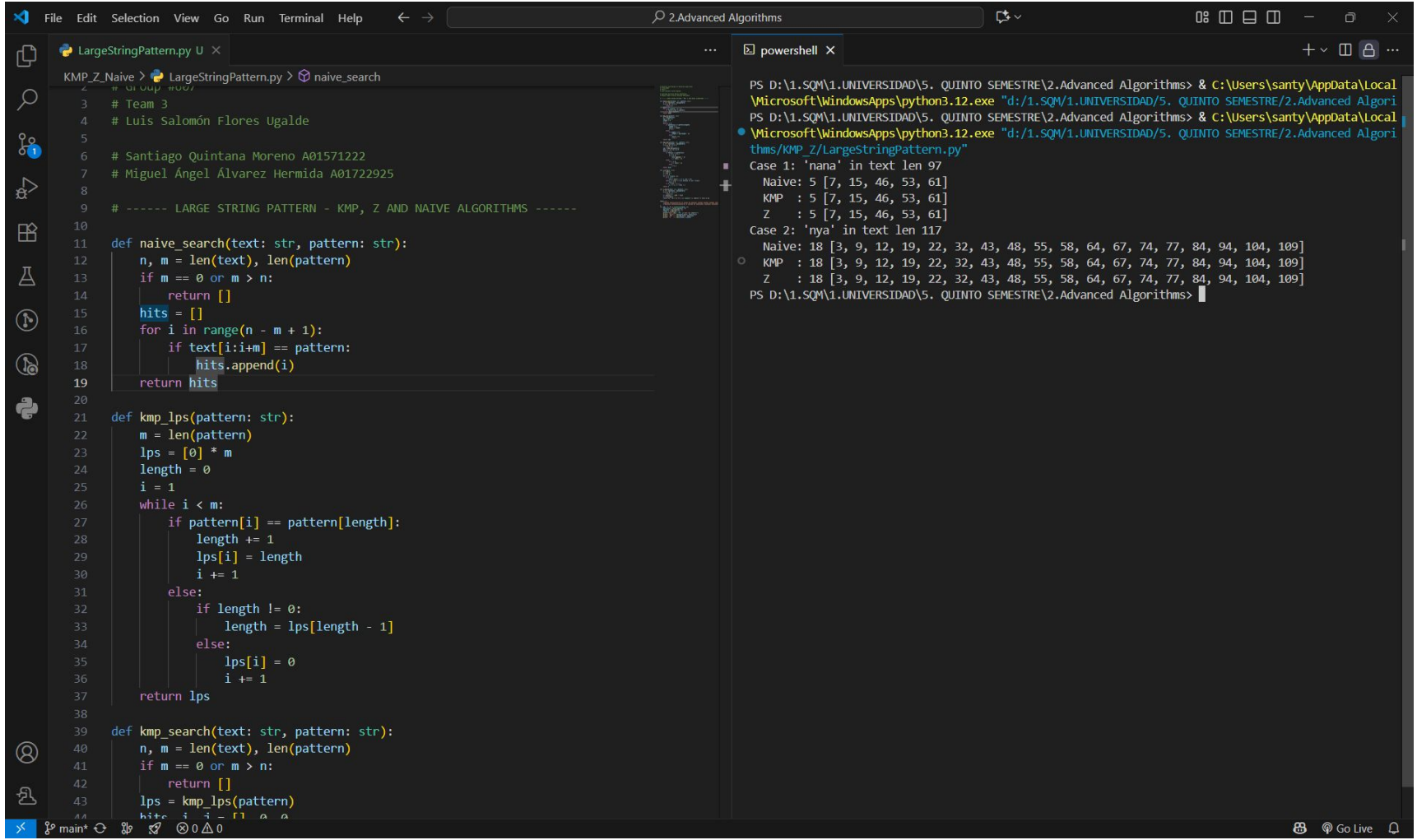
Tecnológico de Monterrey

Tecnológico de Monterrey - Campus Monterrey
School of Engineering and Sciences
Engineering in Computational Technologies
Analysis and Design of Advanced Algorithms

Homework 7:
KPM, Z & NAIVE Algorithms for String search

Group: 607
Team #3
Luis Salomón Flores Ugalde

Santiago Quintana Moreno A01571222
Miguel Ángel Álvarez Hermida a01722925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2.Advanced Algorithms
LargeStringPattern.py U
KMP_Z_Naive > LargeStringPattern.py > naive_search
# Team 3
# Luis Salomón Flores Ugalde
# Santiago Quintana Moreno A01571222
# Miguel Ángel Álvarez Hermida A01722925
# ------ LARGE STRING PATTERN - KMP, Z AND NAIVE ALGORITHMS ------
def naive_search(text: str, pattern: str):
n, m = len(text), len(pattern)
if m == 0 or m > n:
return []
hits = []
for i in range(n - m + 1):
if text[i:i+m] == pattern:
hits.append(i)
return hits
def kmp_lps(pattern: str):
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(text: str, pattern: str):
n, m = len(text), len(pattern)
if m == 0 or m > n:
return []
lps = kmp_lps(pattern)
powershell
PS D:\1.SQM\1.UNIVERSIDAD\5. QUINTO SEMESTRE\2.Advanced Algorithms> & C:\Users\santy\AppData\Local\Microsoft\WindowsApps\python3.12.exe "d:/1.SQM/1.UNIVERSIDAD/5. QUINTO SEMESTRE/2.Advanced Algori
PS D:\1.SQM\1.UNIVERSIDAD\5. QUINTO SEMESTRE\2.Advanced Algorithms> & C:\Users\santy\AppData\Local\Microsoft\WindowsApps\python3.12.exe "d:/1.SQM/1.UNIVERSIDAD/5. QUINTO SEMESTRE/2.Advanced Algorithms/KMP_Z/LargeStringPattern.py"
Case 1: 'nana' in text len 97
Naive: 5 [7, 15, 46, 53, 61]
KMP : 5 [7, 15, 46, 53, 61]
Z : 5 [7, 15, 46, 53, 61]
Case 2: 'nya' in text len 117
Naive: 18 [3, 9, 12, 19, 22, 32, 43, 48, 55, 58, 64, 67, 74, 77, 84, 94, 104, 109]
KMP : 18 [3, 9, 12, 19, 22, 32, 43, 48, 55, 58, 64, 67, 74, 77, 84, 94, 104, 109]
Z : 18 [3, 9, 12, 19, 22, 32, 43, 48, 55, 58, 64, 67, 74, 77, 84, 94, 104, 109]
PS D:\1.SQM\1.UNIVERSIDAD\5. QUINTO SEMESTRE\2.Advanced Algorithms>
main*
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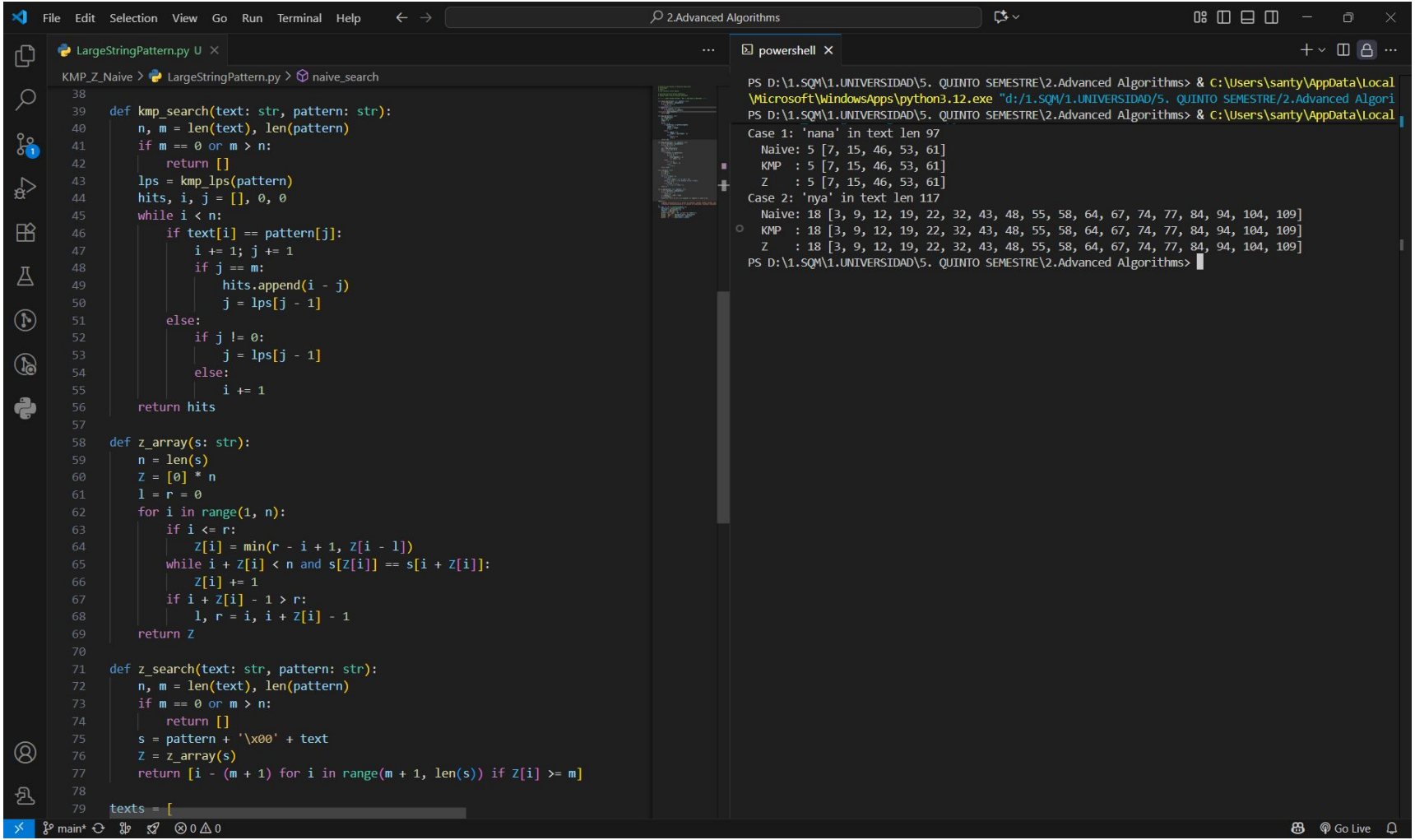
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2.Advanced Algorithms
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def kmp_search(text: str, pattern: str):
n, m = len(text), len(pattern)
if m == 0 or m > n:
return []
lps = kmp_lps(pattern)
hits, i, j = [], 0, 0
while i < n:
if text[i] == pattern[j]:
i += 1; j += 1
if j == m:
hits.append(i - j)
j = lps[j - 1]
else:
if j != 0:
j = lps[j - 1]
else:
i += 1
return hits
def z_array(s: str):
n = len(s)
Z = [0] * n
l = r = 0
for i in range(1, n):
if i <= r:
Z[i] = min(r - i + 1, Z[i - l])
while i + Z[i] < n and s[Z[i]] == s[i + Z[i]]:
Z[i] += 1
if i + Z[i] - 1 > r:
l, r = i, i + Z[i] - 1
return Z
def z_search(text: str, pattern: str):
n, m = len(text), len(pattern)
if m == 0 or m > n:
return []
s = pattern + '\x00' + text
Z = z_array(s)
return [i - (m + 1) for i in range(m + 1, len(s)) if Z[i] >= m]
texts = [
powershell
PS D:\1.SQM\1.UNIVERSIDAD\5. QUINTO SEMESTRE\2.Advanced Algorithms> & C:\Users\santy\AppData\Local\Microsoft\WindowsApps\python3.12.exe "d:/1.SQM/1.UNIVERSIDAD/5. QUINTO SEMESTRE/2.Advanced Algori
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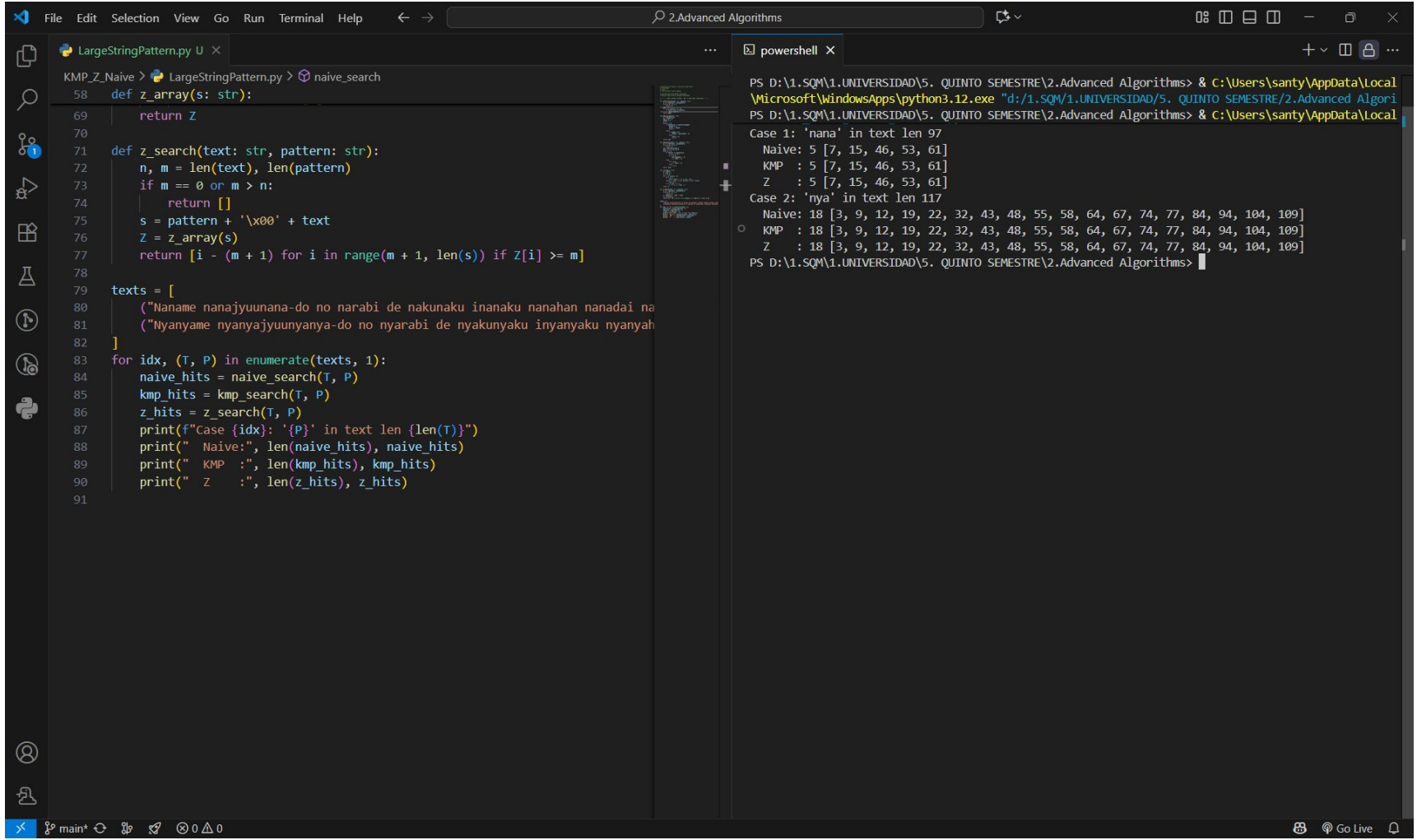
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def z_array(s: str):
return Z
def z_search(text: str, pattern: str):
n, m = len(text), len(pattern)
if m == 0 or m > n:
return []
s = pattern + '\x00' + text
Z = z_array(s)
return [i - (m + 1) for i in range(m + 1, len(s)) if Z[i] >= m]
texts = [
("Naname nanajyuunana-do no narabi de nakunaku inanaku nanahan nanadai na
("Nyanyame nyanyajyuunyanya-do no nyarabi de nyakunyaku inyanyaku nyanyah
]
for idx, (T, P) in enumerate(texts, 1):
naive_hits = naive_search(T, P)
kmp_hits = kmp_search(T, P)
z_hits = z_search(T, P)
print(f"Case {idx}: '{P}' in text len {len(T)}")
print(" Naive:", len(naive_hits), naive_hits)
print(" KMP :", len(kmp_hits), kmp_hits)
print(" Z :", len(z_hits), z_hits)
powershell
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PS D:\1.SQM\1.UNIVERSIDAD\5. QUINTO SEMESTRE\2.Advanced Algorithms>
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https://colab.research.google.com/drive/1BEjJlNtTnKCpEKT0Nx-6uBfw-KMRftNs?usp=sharing

REFERENCES

GeeksforGeeks. (2025, August 27). *KMP algorithm for pattern searching*. GeeksforGeeks. https://www.geeksforgeeks.org/dsa/kmp-algorithm-for-pattern-searching/

GeeksforGeeks. (2025, August 5). *Z algorithm (Linear time pattern searching Algorithm)*. GeeksforGeeks. https://www.geeksforgeeks.org/dsa/z-algorithm-linear-time-pattern-searching-algorithm/

GeeksforGeeks. (2024, April 20). *Naive algorithm for Pattern Searching*. GeeksforGeeks. https://www.geeksforgeeks.org/dsa/naive-algorithm-for-pattern-searching/