**20181019数据结构作业**

**1800022769 张靖昆 20181019**

**我承诺诚实作业，没有抄袭他人！**

**P98第9题：**求字符串“BAAABBBAA”的特征向量，并与目标串“BAAABBBCDDDCCHHHHBBBAAABBBAADD”进行匹配，试画出匹配的过程示意图。

1. **求解特征向量（非优化KMP算法下的特征向量）**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 下标 | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 字符 | B | A | A | A | B | B | B | A | A |
| next | -1 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 2 |

**步骤：**

1. 考察第0位字符‘B’，由于他前面没有字符，从而next设置为-1，表示当回溯到此时主串指针应当+1，重新开始匹配；
2. 考察第1位字符‘A’，由于他前面就是第0位字符，从而在他这里匹配失败时，只能回溯到第0位，从而next设置为0；
3. 考察第2位字符‘A’，由于他前面的字符‘A’与它next值对应的字符‘B’不等，又next值已经指向的已经是第0位，从而next设置为0；
4. 考察第3、4位的情况都与第2位相同，从而next值设置为0；
5. 考察第5位字符‘B’，由于他左邻字符‘B’与第0位相同，表示当在第5位匹配失败时，主串中左边一位与第5位字符左邻字符相同，从而可以回溯到第1位字符，因此next设置为1；
6. 考察第6位字符‘B’，由于他左邻字符‘B’与左邻字符next值对应的字符‘A’不等，此时应当取字符‘A’的next值对应的字符来比较，发现相等，从而第6位next应当设置为1；
7. 第7位字符‘A’与第6位相似，next值为1；
8. 考察第8位字符，由于其左邻字符‘A’与该字符next值对应字符相等，从而表示在第8位匹配失败时，主串中与第8位字符相对应的字符左边2位与第8位左边两位字符相等，又第1,2位字符与第8位左边两位字符相等，从而回溯时只需回溯到第2位即可，从而第8位字符的next值为2。

**综上，特征向量next = {-1, 0, 0, 0, 0, 1, 1, 1, 2}。**

1. **匹配过程示意图**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 主串下标 | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
| 指针i |  |  |  |  |  |  |  | ↓ |  |  |  |  |
| 主串 | B | A | A | A | B | B | B | C | D | D | D | C |
| 模式串 | B | A | A | A | B | B | B | A | A |  |  |  |
| 指针j |  |  |  |  |  |  |  | ↑ |  |  |  |  |
| 模式串下标 | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |  |  |  |

1. **第一次匹配**

**结论**：第一次匹配失败，在主串下标为7时，那么此时将指针j按照特征向量回溯到1从新进行匹配。

1. **第二次匹配**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 主串下标 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 |
| 指针i |  | ↓ |  |  |  |  |  |  |  |  |  |  |
| 主串 | B | C | D | D | D | C | C | H | H | H | H | B |
| 模式串 | B | A | A | A | B | B | B | A | A |  |  |  |
| 指针j |  | ↑ |  |  |  |  |  |  |  |  |  |  |
| 模式串下标 | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |  |  |  |

**结论**：第二次匹配依然失败，并且依旧是在主串下标为7时，此时按照特征向量将指针j回溯到0进行匹配。

1. **第三次匹配**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 主串下标 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
| 指针i | ↓ |  |  |  |  |  |  |  |  |  |  |  |
| 主串 | C | D | D | D | C | C | H | H | H | H | B | B |
| 模式串 | B | A | A | A | B | B | B | A | A |  |  |  |
| 指针j | ↑ |  |  |  |  |  |  |  |  |  |  |  |
| 模式串下标 | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |  |  |  |

**结论**：第三次匹配依然失败，此时由于模式串指针j已经在模式串的第一位，那么应当将指针i+1,重新匹配。

1. **第四次匹配-第十二次匹配**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 主串下标 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 |
| 指针i | ↓ |  |  |  |  |  |  |  |  |  |  |  |
| 主串 | D | D | D | C | C | H | H | H | H | B | B | B |
| 模式串 | B | A | A | A | B | B | B | A | A |  |  |  |
| 指针j | ↑ |  |  |  |  |  |  |  |  |  |  |  |
| 模式串下标 | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |  |  |  |

**结论**：由于第四次发现依然不匹配，此时应当继续将指针i+1，直至达到主串下标17时，发现重新出现匹配，在此之前已经匹配到第十二次，所以接下来进行第十三次匹配。

1. **第十三次匹配**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 主串下标 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 |
| 指针i |  | ↓ |  |  |  |  |  |  |  |  |  |  |
| 主串 | B | B | B | A | A | A | B | B | B | A | A | D |
| 模式串 | B | A | A | A | B | B | B | A | A |  |  |  |
| 指针j |  | ↑ |  |  |  |  |  |  |  |  |  |  |
| 模式串下标 | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |  |  |  |

**结论**：第十三次匹配失败。此时指针i指向主串下标18，指针j指向模式串下标1，按照特征向量值指针j回溯到下标0，重新开始匹配。

1. **第十四次匹配**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 主串下标 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 |
| 指针i |  | ↓ |  |  |  |  |  |  |  |  |  |  |
| 主串 | B | B | A | A | A | B | B | B | A | A | D | D |
| 模式串 | B | A | A | A | B | B | B | A | A |  |  |  |
| 指针j |  | ↑ |  |  |  |  |  |  |  |  |  |  |
| 模式串下标 | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |  |  |  |

**结论**：第十四次匹配失败。此时，指针i指向主串下标19，指针j指向模式串下标1，按照特征向量指针j回溯到下标0，重新开始匹配。

1. **第十五次匹配**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 主串下标 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 |  |
| 指针i |  |  |  |  |  |  |  |  | ↓ |  |  |  |
| 主串 | B | A | A | A | B | B | B | A | A | D | D |  |
| 模式串 | B | A | A | A | B | B | B | A | A |  |  |  |
| 指针j |  |  |  |  |  |  |  |  | ↑ |  |  |  |
| 模式串下标 | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |  |  |  |

**结论**：**第十五次匹配成功**！从第十四匹配失败指针j回溯到模式串下标0开始重新匹配，直至到模式串最后一位所有字符都匹配，从而匹配成功。此时指针j指向主串下标27，指针j指向模式串下标8，那么主串中匹配的子串第一位下标为i-j=19。