P1.

1. Bottom-up

2

15 12

10 6 14 8

2

15 14

10 6 12 8

15

2 14

10 6 12 8

15

10 14

2 6 12 8

1. Top-down

2

15

15

2 12

10

15

10 12

2 6 14

15

10 14

2 6 12 8

c) It is not always true that the two algorithms will yield the same heap for the same input

P2.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Char | T | C | A | \*\* |
| Shift | 1 | 3 | 6 | 11 |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| T | T | A | T | A | G | A | T | C | T | C | G | T | A | T | T | C | T | T | T | T | A | T | A | G | A | T | C | T | C | C | T | A | T | T | C | T | T | T |
| T | C | C | T | A | T | T | C | T | T | T |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  | T | C | C | T | A | T | T | C | T | T | T |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  | T | C | C | T | A | T | T | C | T | T | T |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  | T | C | C | T | A | T | T | C | T | T | T |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  | T | C | C | T | A | T | T | C | T | T | T |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | T | C | C | T | A | T | T | C | T | T | T |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | T | C | C | T | A | T | T | C | T | T | T |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | T | C | C | T | A | T | T | C | T | T | T |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | T | C | C | T | A | T | T | C | T | T | T |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | T | C | C | T | A | T | T | C | T | T | T |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | T | C | C | T | A | T | T | C | T | T | T |

P3.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| K | 63 | 42 | 45 | 64 | 53 | 41 |
| K mod 11 | 8 | 9 | 1 | 9 | 9 | 8 |

a.

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|  | 45 |  |  |  |  |  |  | 63 | 42 |  |
|  |  |  |  |  |  |  |  | 41 | 64 |  |
|  |  |  |  |  |  |  |  |  | 53 |  |

Largest number of key comparisons: 3

b.

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 53 | 45 | 41 |  |  |  |  |  | 63 | 42 | 64 |

Largest number of key comparisons: 6