

# Data structures

## *Index of T*

C G T G C : 0 , 4

G C G T G : 3

G T G C C : 1

G T G C T : 5

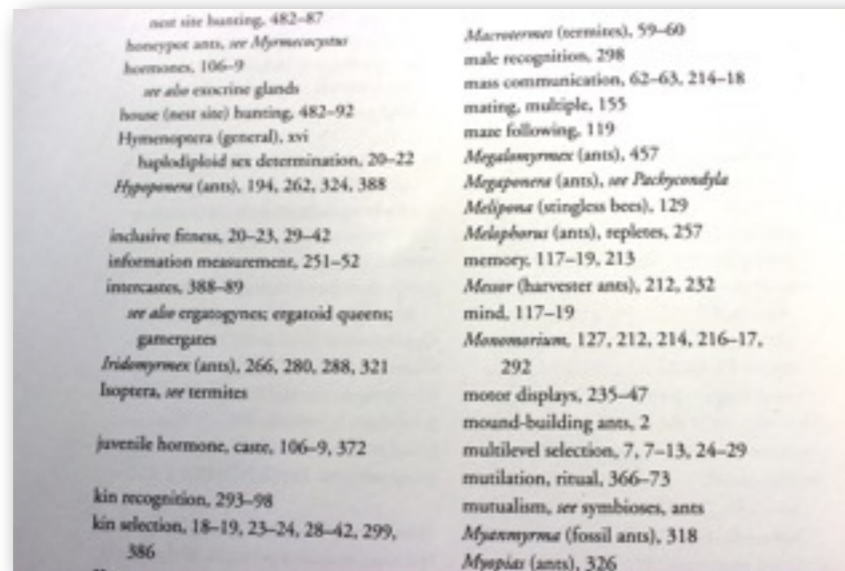
T G C C T : 2

T G C T T : 6

## **Multimap**

*T*: C G T G C G T G C T T

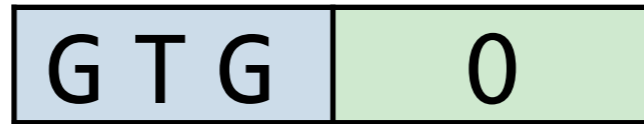
# Data structures



## Multimap

*T*: C G T G C G T G C T T

# Data structures



*T*: G T G C G T G T G G G G

# Data structures

G T G	0
T G C	1

*T*: G T G C G T G T G G G G

# Data structures

G T G	0
T G C	1
G C G	2

*T*: G T G C G T G T G G G G

# Data structures

G T G	0
T G C	1
G C G	2
C G T	3
G T G	4
T G T	5
G T G	6
T G G	7
G G G	8
G G G	9
G G G	10

*T*: G T G C G T G T G G G G G

# Data structures

Alphabetical  
by k-mer



C G T	3
G C G	2
G G G	8
G G G	9
G G G	10
G T G	0
G T G	4
G T G	6
T G C	1
T G G	7
T G T	5

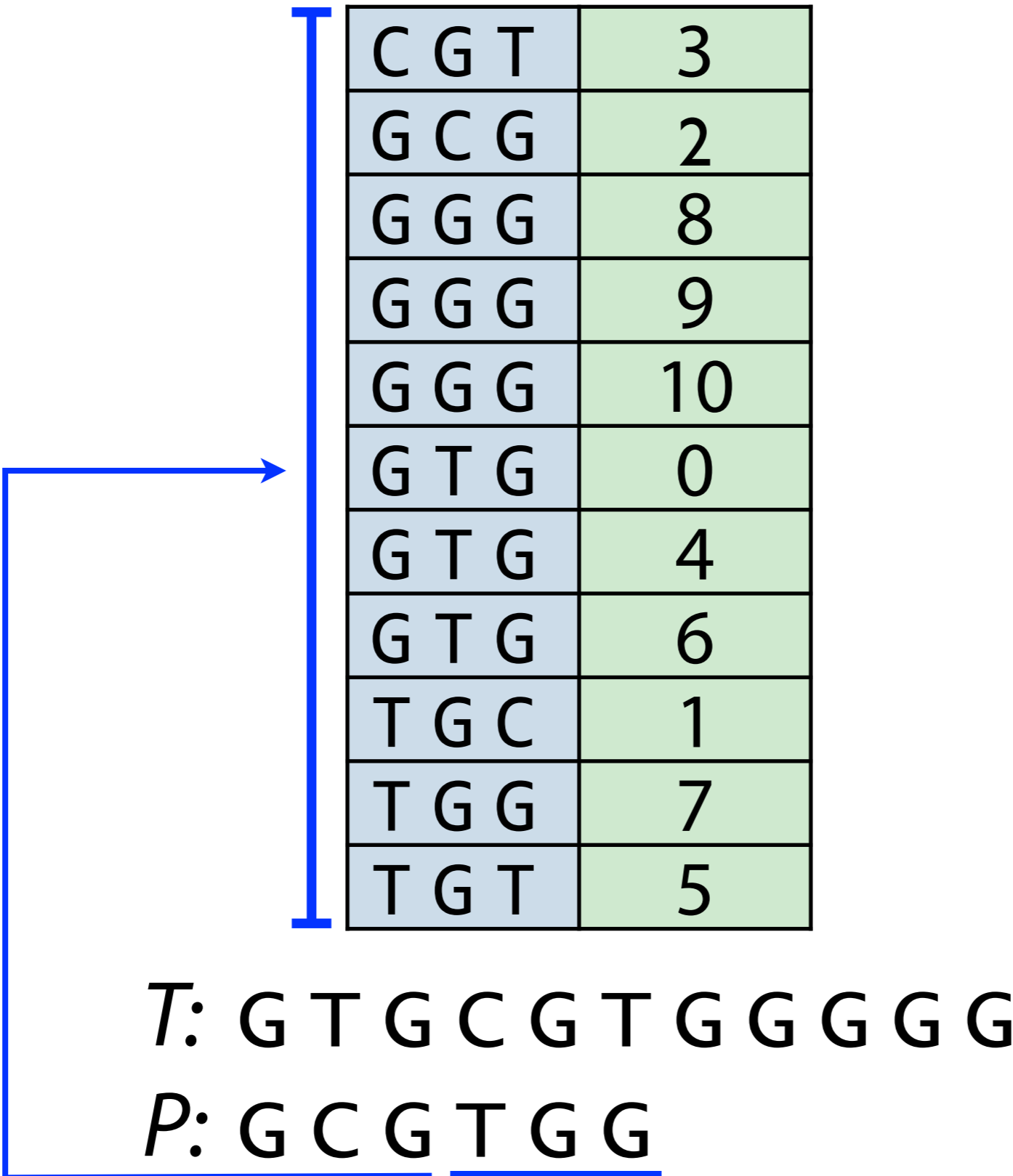
*T*: G T G C G T G T G G G G G

# Data structures

- nest site hunting, 482–87
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# Binary search



# Binary search

TGG > GTG



C G T	3
G C G	2
G G G	8
G G G	9
G G G	10
G T G	0
G T G	4
G T G	6
T G C	1
T G G	7
T G T	5

T: G T G C G T G G G G G

P: G C G T G G

# Binary search

After 1<sup>st</sup>  
bisection

T G G > T G C

C G T	3
G C G	2
G G G	8
G G G	9
G G G	10
G T G	0
G T G	4
G T G	6
T G C	1
T G G	7
T G T	5

T: G T G C G T G G G G G

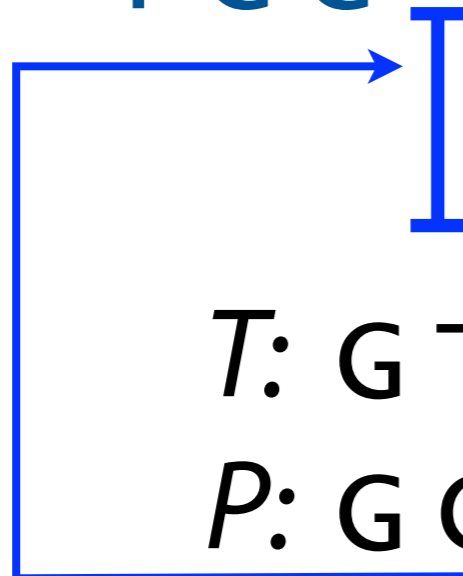
P: G C G T G G

# Binary search

After 2<sup>nd</sup>  
bisection

C G T	3
G C G	2
G G G	8
G G G	9
G G G	10
G T G	0
G T G	4
G T G	6
T G C	1
T G G	7
T G T	5

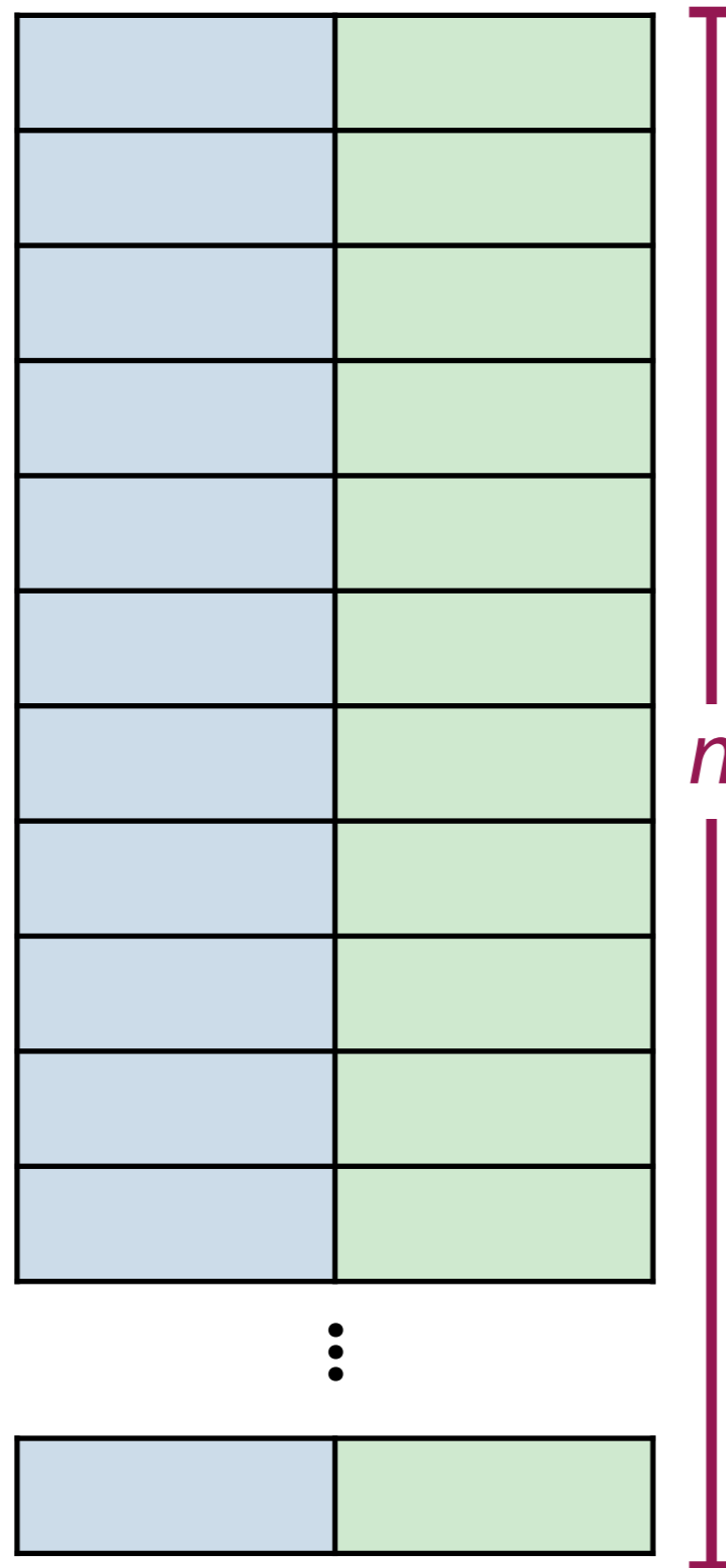
T G G = T G G



*T*: G T G C G T G G G G G


*P*: G C G T G G

# Binary search



$\sim \log_2(n)$  bisections  
per query

`bisect.bisect_left(a, x)`: Leftmost offset where `x` can be inserted into `a` to maintain order



```
>>> a = [1, 3, 3, 6, 8, 8, 9, 10]
>>> import bisect
>>> bisect.bisect_left(a, 2)
1
>>> bisect.bisect_left(a, 4)
3
>>> bisect.bisect_left(a, 8)
4
```

bisect\_left(index, 'GTG')

C G T	3
G C G	2
G G G	8
G G G	9
G G G	10
G T G	0
G T G	4
G T G	6
T G C	1
T G G	7
T G T	5

*T*: G T G C G T G G G G G  
*P*: G C G T G G

