

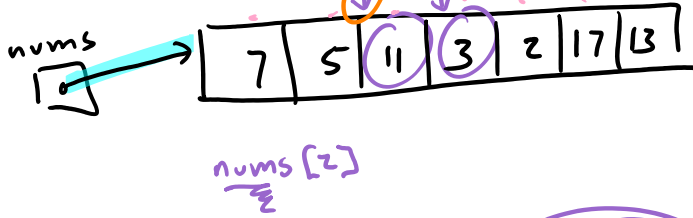
qsort

```

qsort(basenums, 7, sizesizeof(*nums), compare-ints);

```

base + 2 * size



```

int compare-ints(const void *p1,
                 const void *p2)
{
    const int *i1 = p1;
    const int *i2 = p2;
    return *i1 - *i2;
}

```

```

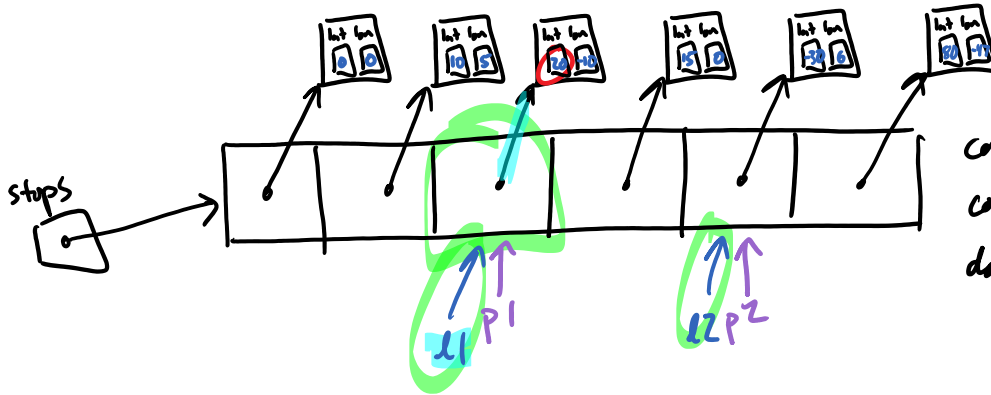
qsort(stops, num-stops, sizeof(*stops), compare-by-lat);

```

```

int compare-by-lat(const void *p1,
                  const void *p2)
{
    :
}

```

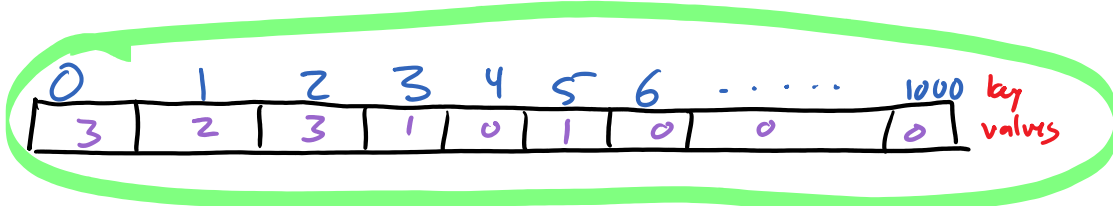


```

const location *l1 = p1;
const location *l2 = p2;
double lat1 = loc_get_lat(*l1);
:

```

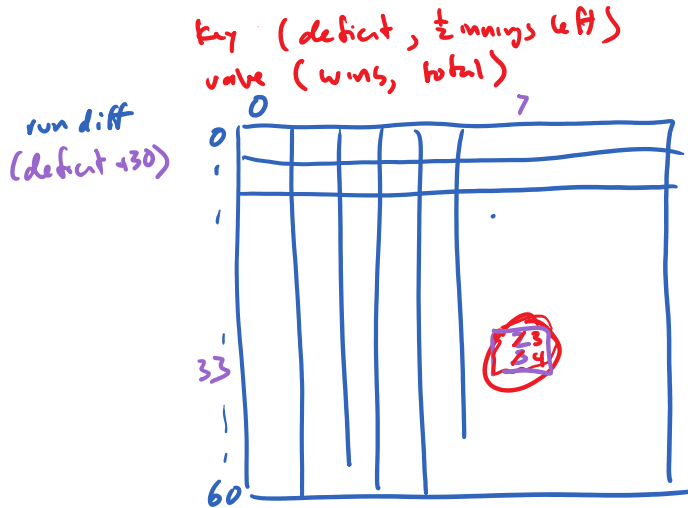
siblings frequency



day of week



compute $P(\text{win} \mid \text{deficit} / \text{half innings left})$



deficit	innings	w/L
0	2.5	W
0	5.5	L
3	3.5	W
3	3.5	L
3	3.5	W
3	3.5	W
3	3.5	W

airports

$$\begin{aligned} 000 &\rightarrow 0 \cdot 1 + 0 \cdot 36 + 0 \cdot 36^2 \\ \underline{HVN} &\rightarrow 23 \cdot 1 + 31 \cdot 36 + 17 \cdot 36^2 \\ \underline{\underline{ZZZ}} &\rightarrow 35 \cdot 1 + 35 \cdot 36 + 35 \cdot 36^2 \end{aligned}$$

key	value
Trek	111
Scott	1
Diamondback	11
Schunn	1

Map: records keys and associated values

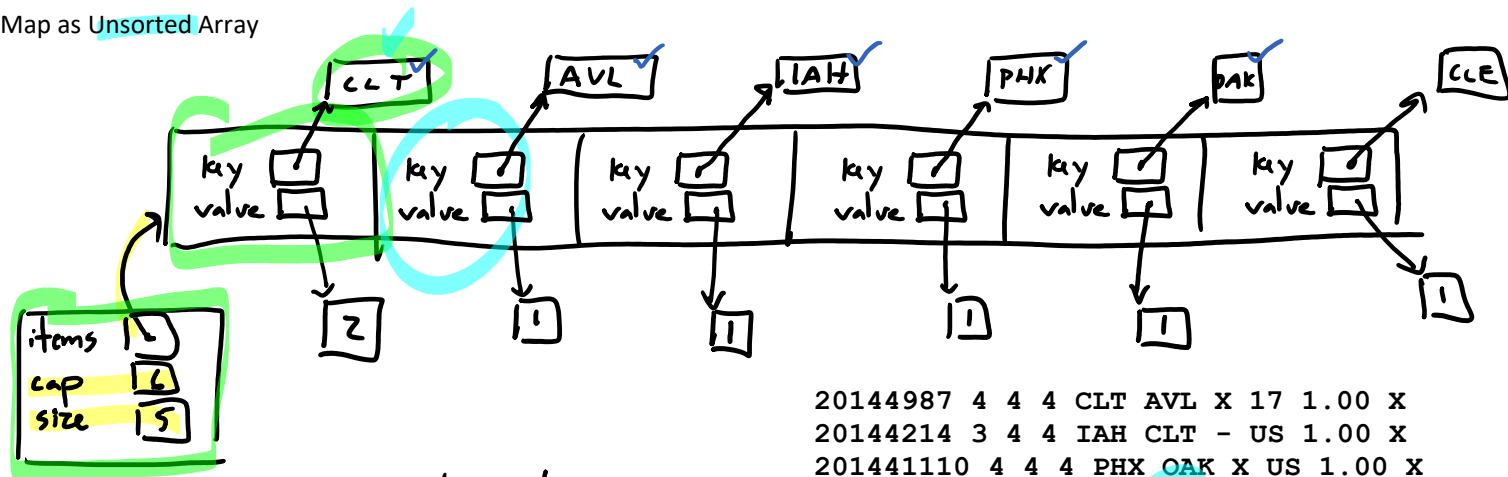
key	value
domain name	ip address
tick.zoo.cs.yale.edu	128.36.232.50
maps.google.com	
grizzly.zoo.cs.yale.edu	128.36.232.18

contains-key: determine if key present in map

get: return value associated w given key

put: stores key and associated value in map (replace old value if key already present)

Map as Unsorted Array



```

20144987 4 4 4 CLT AVL X 17 1.00 X
20144214 3 4 4 IAH CLT - US 1.00 X
201441110 4 4 4 PHX OAK X US 1.00 X
20144794 3 4 4 CLE CLT - 16 1.00 X
  
```

```

Struct entry {
  char vchar;
  size_t vvalue;
};
  
```

contains_key
 sequential search
 worst case $O(n)$

get
 sequential search
 worst case $O(n)$

put
 sequential search
 worst case $O(n)$

Map as Hash Table

```

20144987 4 4 4 CLT AVL X 17 1.00 X
20144214 3 4 4 IAH CLT - US 1.00 X
201441110 4 4 4 PHX OAK X US 1.00 X
20144794 3 4 4 CLE CLT - 16 1.00 X
20144756 2 4 4 CLT BOS X US 1.00 X
201441020 2 4 4 CLT MCO X US 1.00 X
201441578 4 5 4 BNA PHL - YX 1.00 X
201442030 4 4 4 DCA BHM X US 1.00 X
201442094 3 4 4 CHS CLT - 16 1.00 X
201441020 1 4 4 AVL CLT - 16 1.00 X
201441020 3 4 4 MCO CLT - US 1.00 X
    
```

hash function

CLT → 66827 % 8 = 3
 AVL → 65207 % 8 = 7
 IAH → 72240 % 8 = 0
 PHX → 79200 % 8 = 0
 OAK
 CLE
 BOS
 MCO

hash table

	key	value
0	IAH	1
1		
2		
3	CLT	1
4		
5		
6		
7	AVL	1

collision!

