mispellings

`speller.c`

1. calls `load` on the dictionary file
   - dictionary contains valid words, one per line
2. calls `check` on each word in the text file and prints all misspelled words
3. calls `size` to determine number of words in dictionary
4. calls `unload` to free up memory

TODO

- `load`
  - loads the dictionary
- `check`
  - checks if a given word is in the dictionary
- `size`
  - returns the number of words in the dictionary
- `unload`
  - frees the dictionary from memory

TODO

- □ `load`
- □ `check`
- □ `size`
- □ `unload`

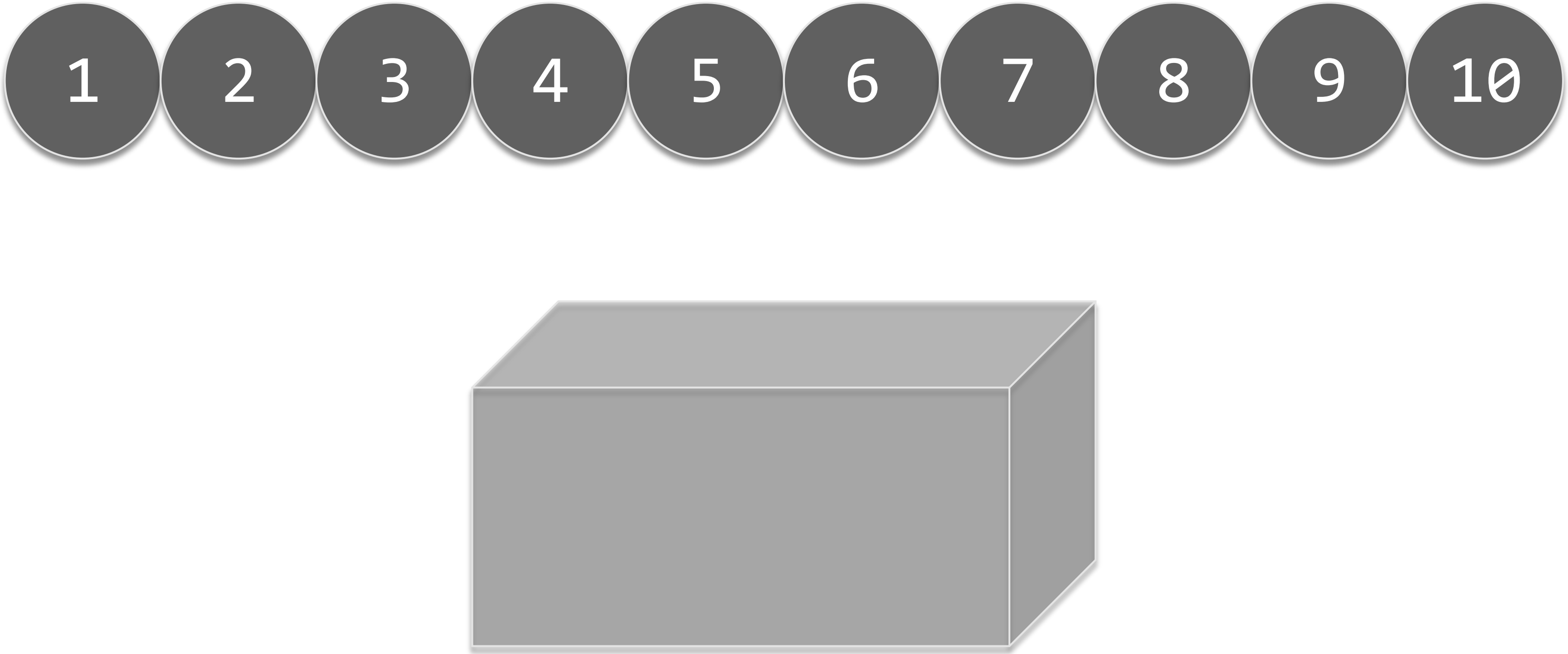
`load`

- for each word in the dictionary text file, store it in the dictionary’s data structure
  - linked lists
  - hash tables
  - tries

hash tables

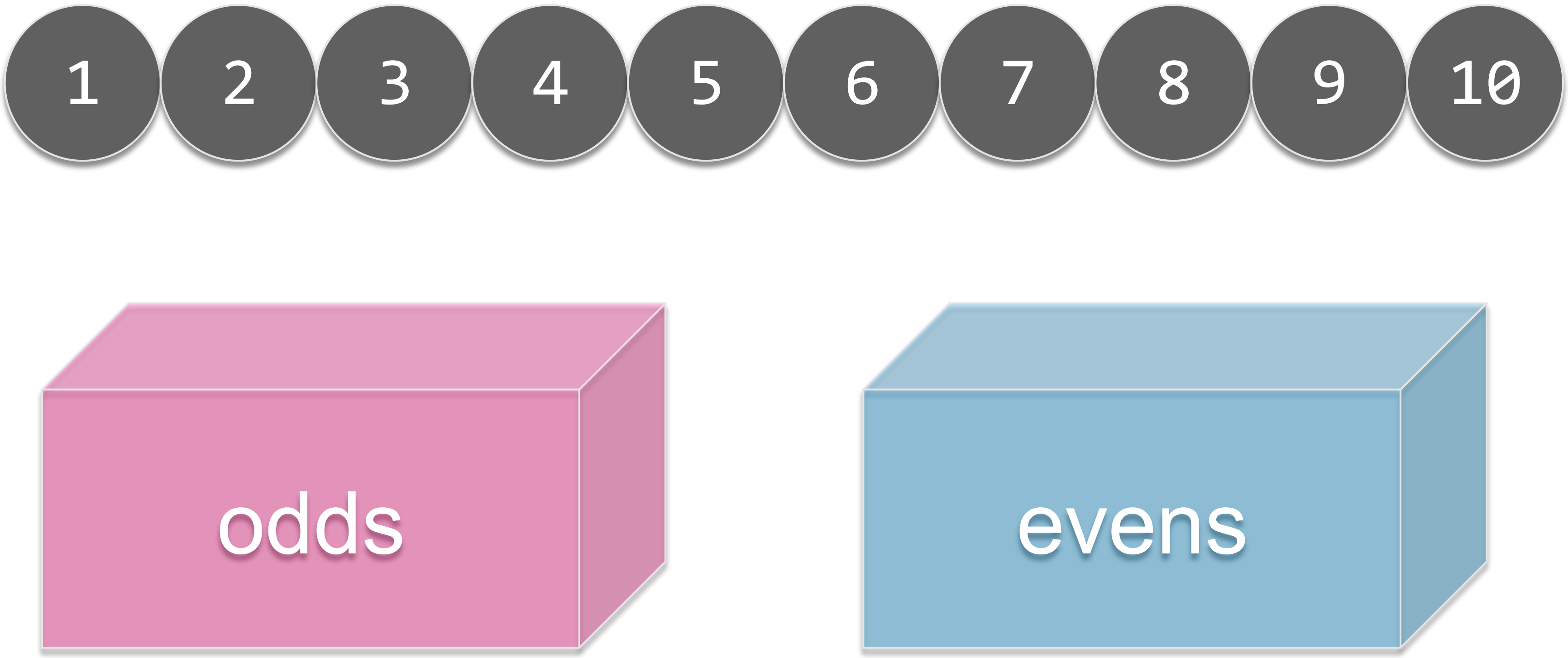
- an array of buckets
- hash function
  - returns the bucket that a given key belongs to

hash tables

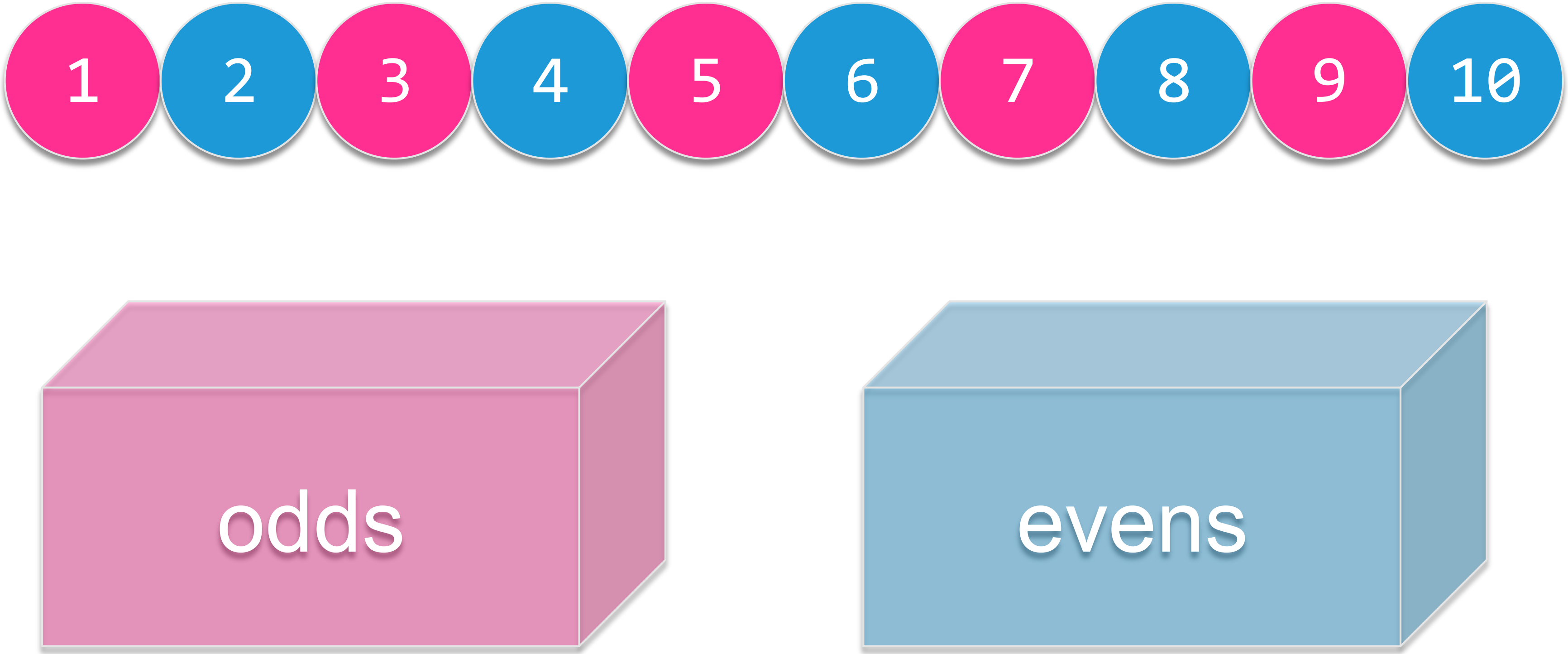


1 2 3 4 5 6 7 8 9 10

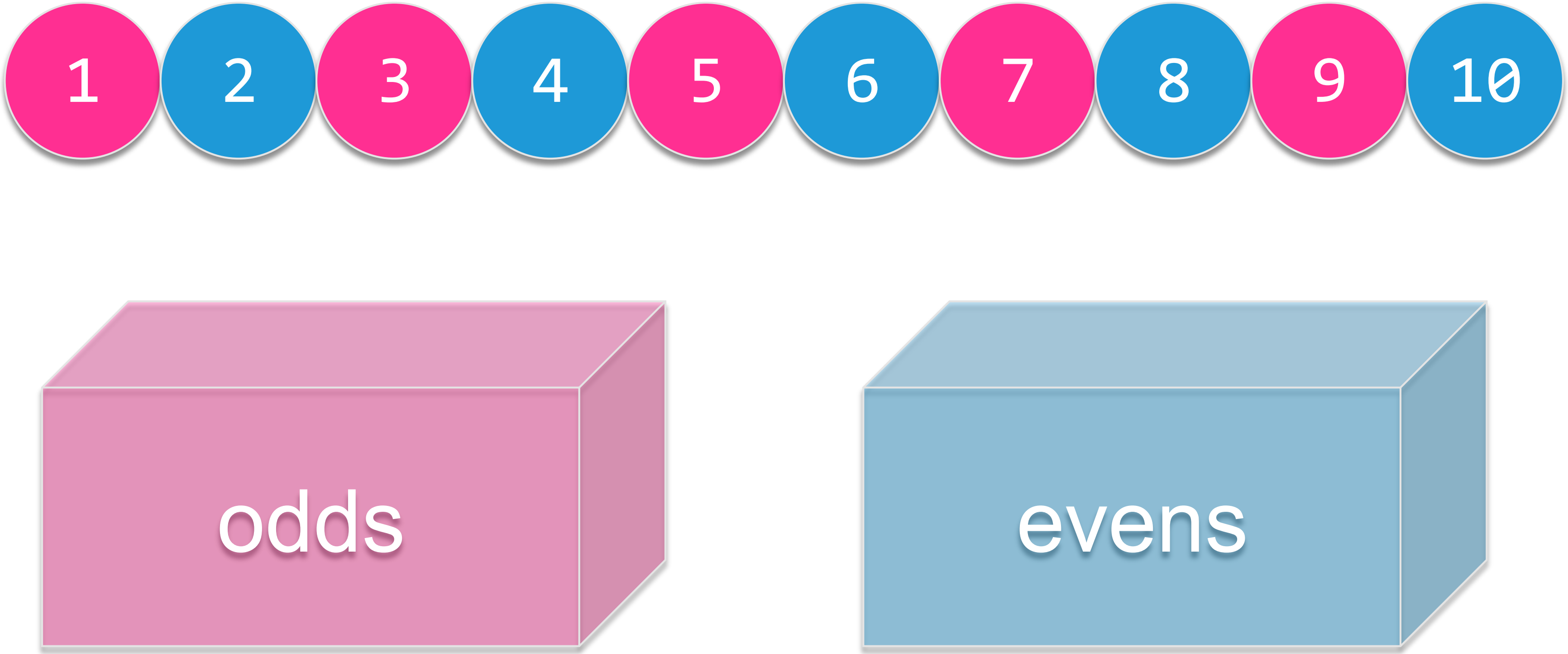
hash tables



hash tables

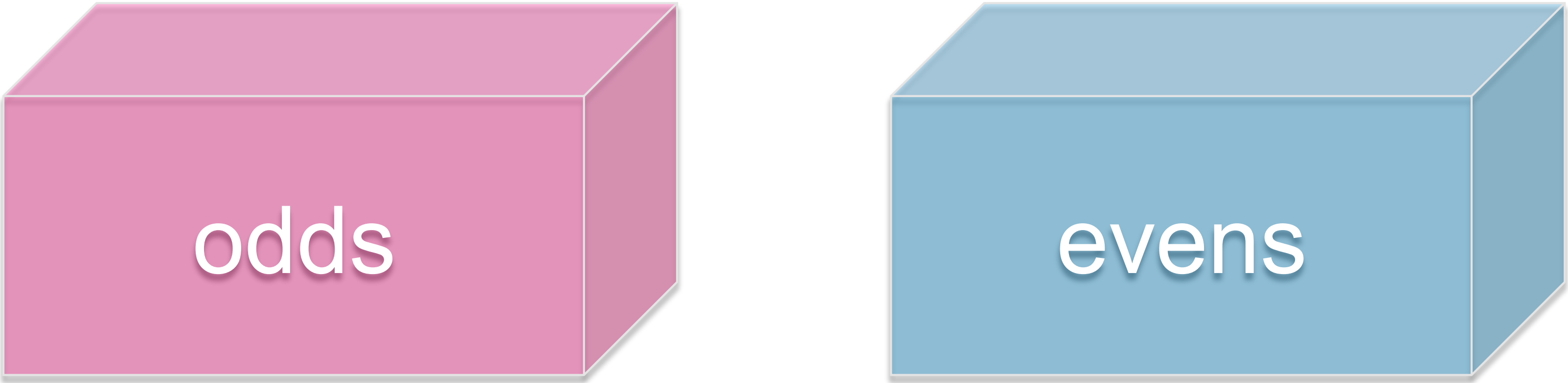


hash tables

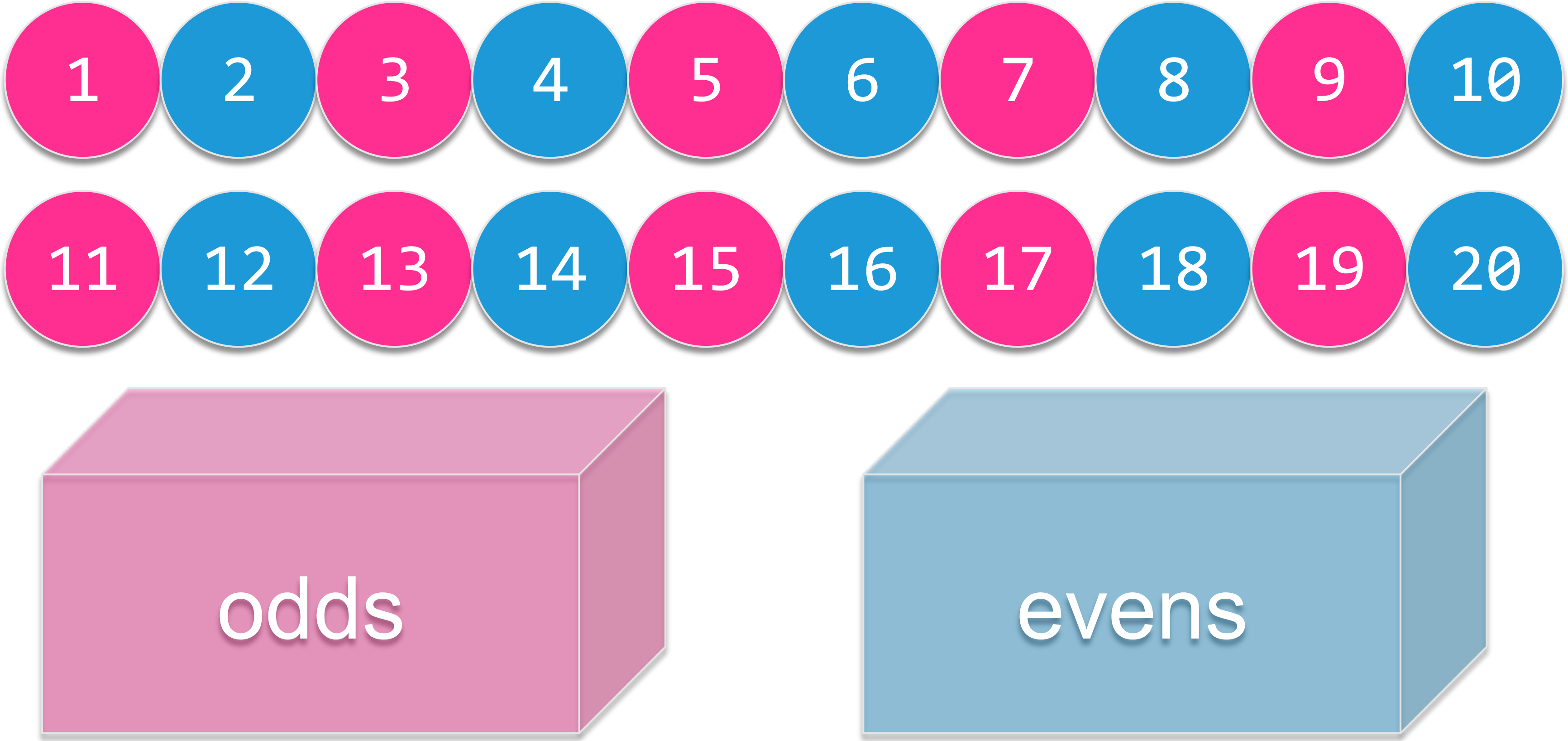


hash tables

- hash table: 2 buckets
- hash function: `if (n % 2 == 1), odd box`
  `else, even box`



hash tables



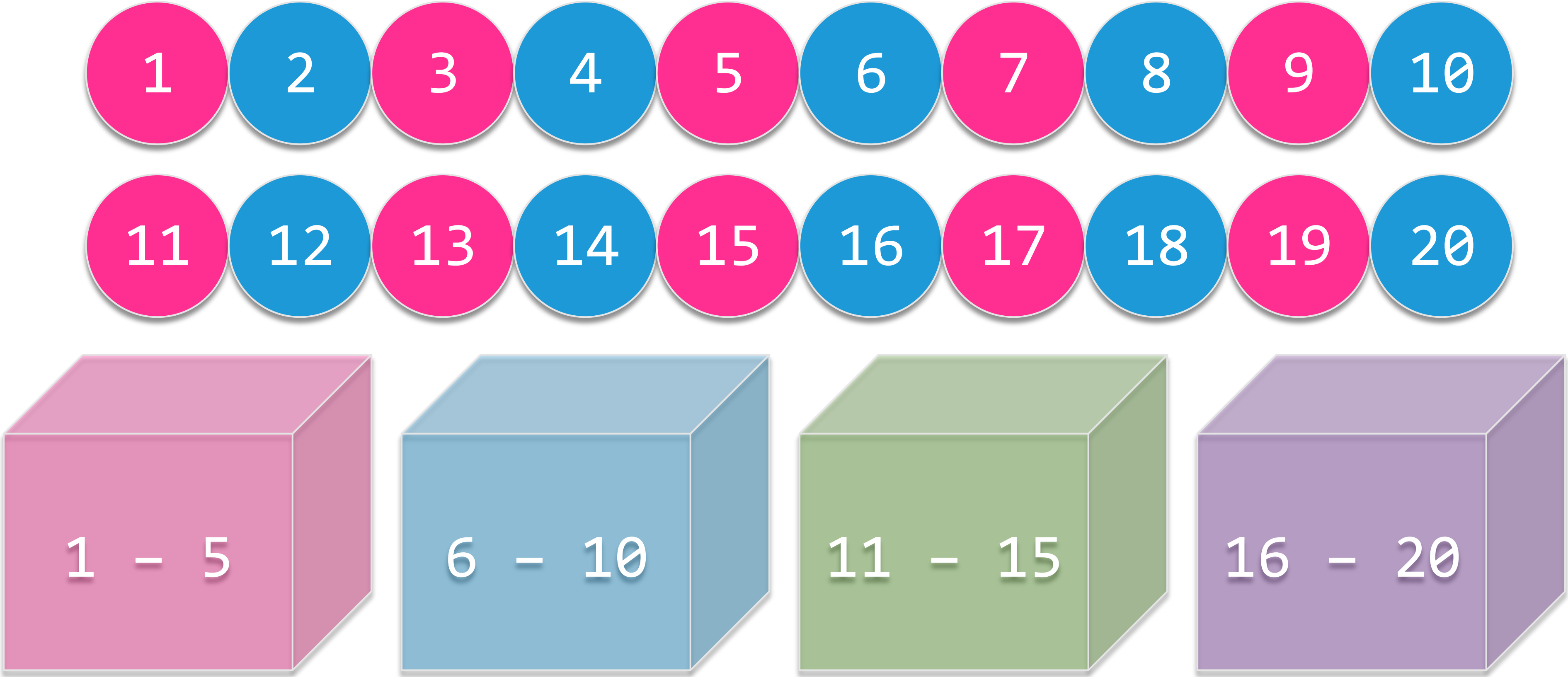
1 2 3 4 5 6 7 8 9 10

11 12 13 14 15 16 17 18 19 20

odds

evens

hash tables



1 2 3 4 5 6 7 8 9 10

11 12 13 14 15 16 17 18 19 20

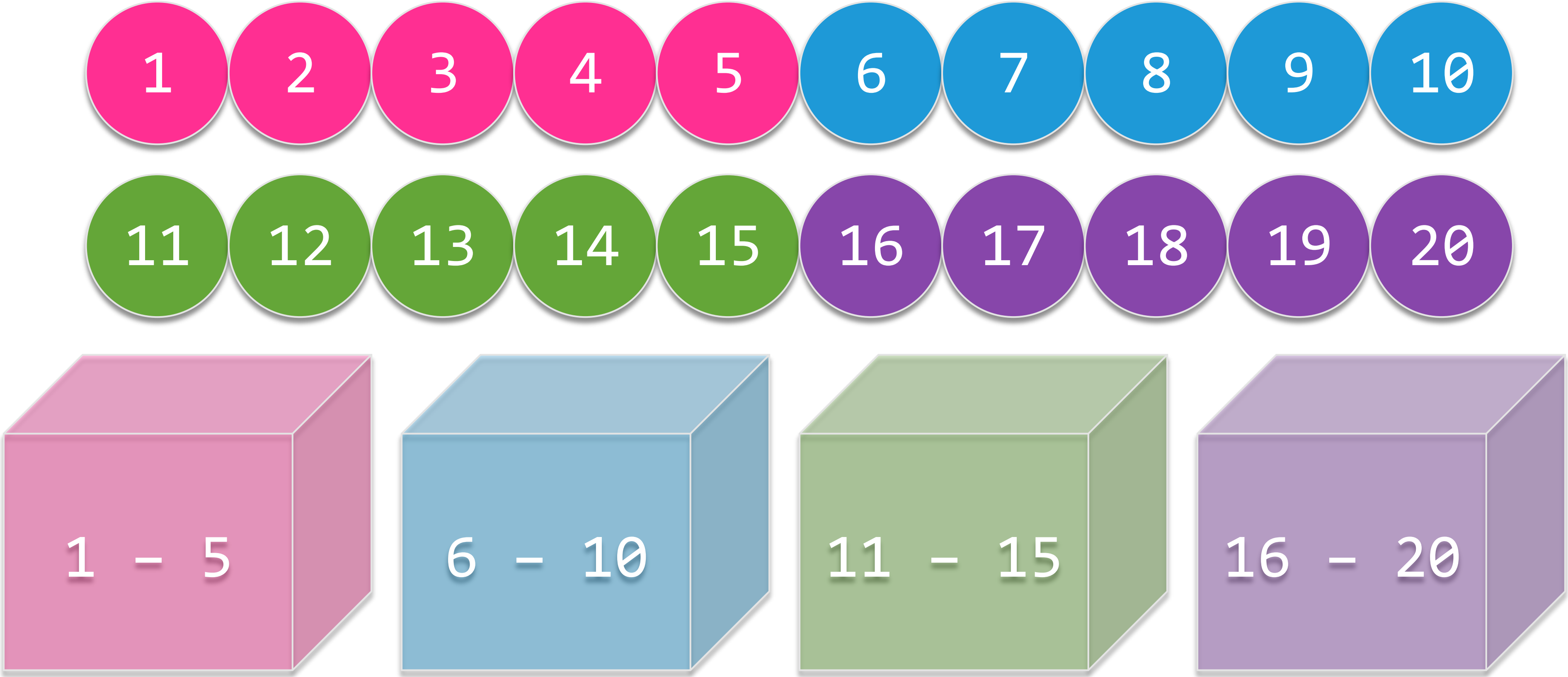
1 - 5

6 - 10

11 - 15

16 - 20

hash tables



1 2 3 4 5 6 7 8 9 10

11 12 13 14 15 16 17 18 19 20

1 - 5

6 - 10

11 - 15

16 - 20

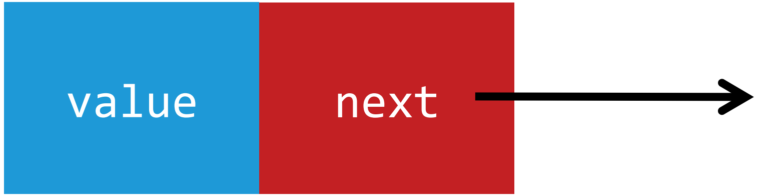
hash tables

- a hash table is an array of buckets
- each bucket is a linked list

a hash table is
an array of linked lists

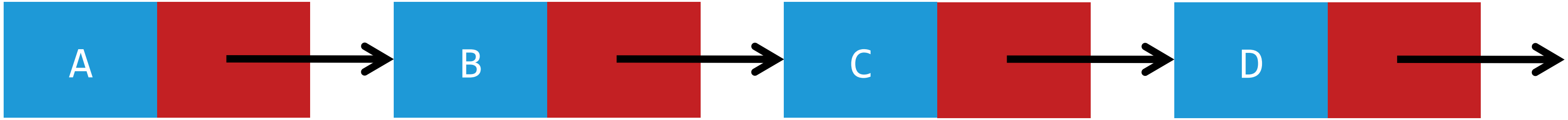
nodes

- each node has a value, as well as a pointer to the next node

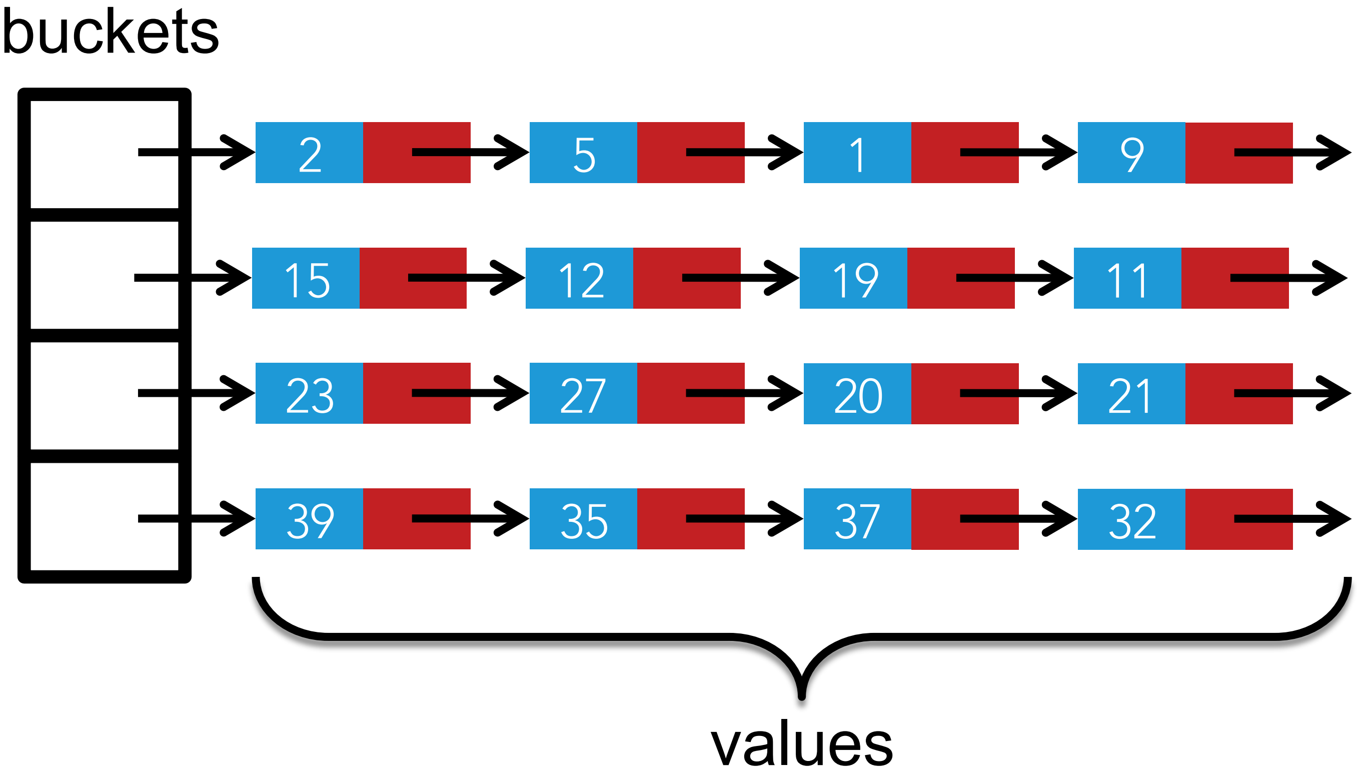


linked lists

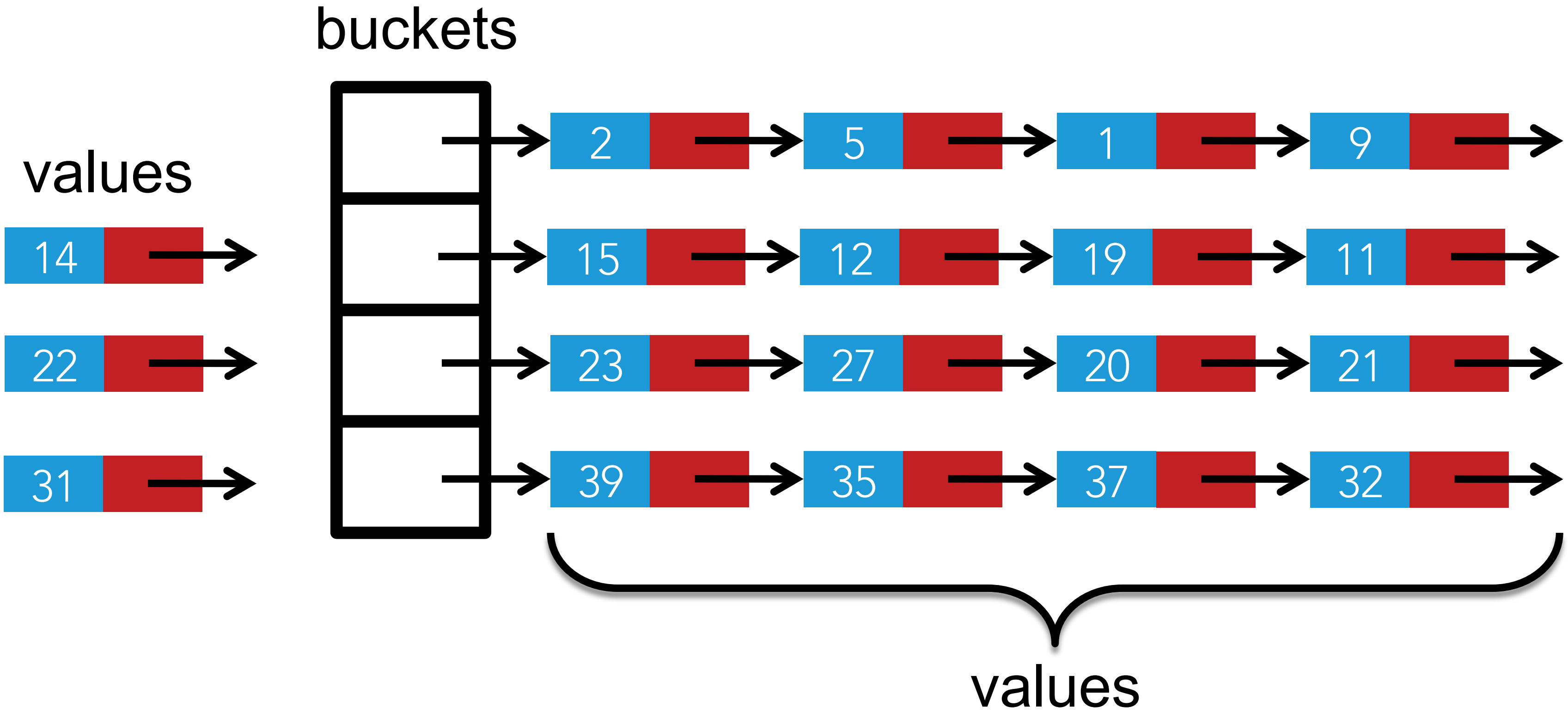
- important:
  - don’t lose any links!
  - last node points to NULL



hash tables

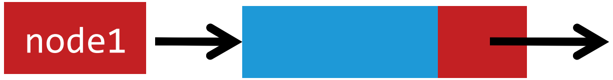


hash tables


buckets
values
14
22
31
2
5
1
9
15
12
19
11
23
27
20
21
39
35
37
32
values

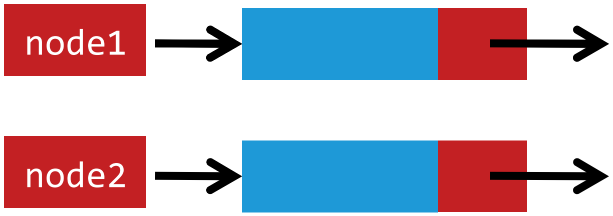
linked lists

```
typedef struct node
{
    char word[LENGTH + 1];
    struct node *next;
}
node;

node *node1 = malloc(sizeof(node));
```



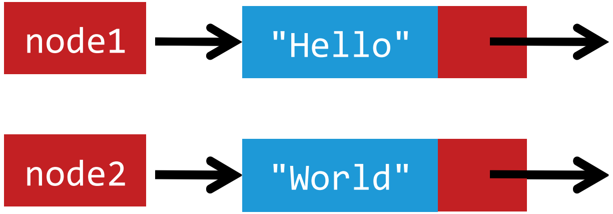
linked lists

```
typedef struct node
{
    char word[LENGTH + 1];
    struct node *next;
}
node;

node *node1 = malloc(sizeof(node));
node *node2 = malloc(sizeof(node));
```



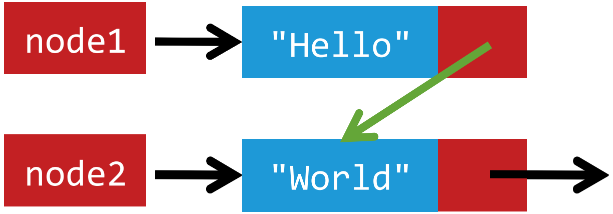
linked lists

```
typedef struct node
{
    char word[LENGTH + 1];
    struct node *next;
}
node;

node *node1 = malloc(sizeof(node));
node *node2 = malloc(sizeof(node));
node1->word = "Hello";
node2->word = "World";
```



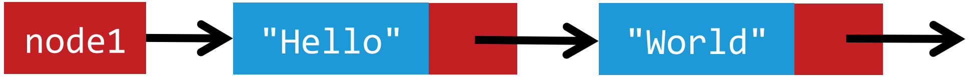
linked lists

```
typedef struct node
{
    char word[LENGTH + 1];
    struct node *next;
}
node;

node *node1 = malloc(sizeof(node));
node *node2 = malloc(sizeof(node));
node1->word = "Hello";
node2->word = "World";
node1->next = node2;
```



linked lists

```
typedef struct node
{
    char word[LENGTH + 1];
    struct node* next;
}
node;

node *node1 = malloc(sizeof(node));
node *node2 = malloc(sizeof(node));
node1->word = "Hello";
node2->word = "World";
node1->next = node2;
```



a hash table is an array of linked lists

each element of array is a node *

hash table

```
typedef struct node
{
     char word[LENGTH + 1];
     struct node *next;
}
node;

node *hashtable[50];
```

a hash table is an array of linked lists

each element of array is a node *

make a new word

- scan dictionary word by word

```
while (fscanf(file, "%s", word) != EOF)
{
    ...
}
```

make a new word

- malloc a node * for each new word

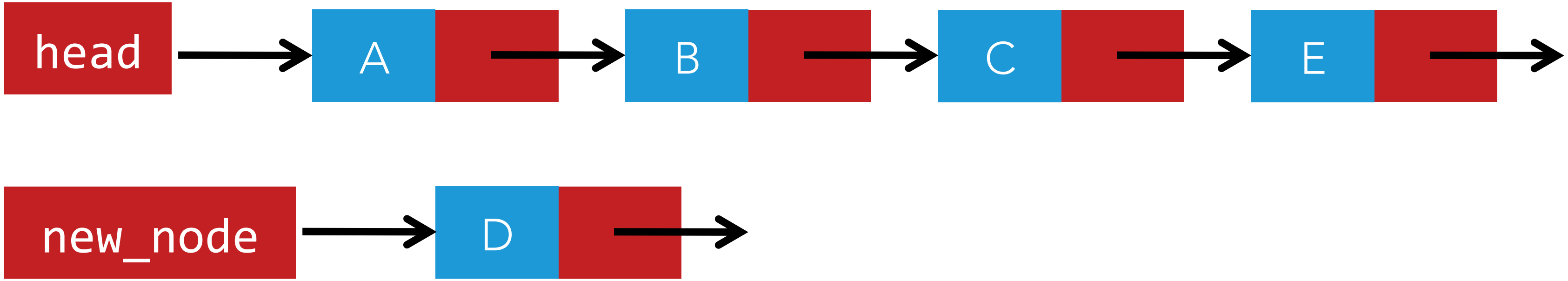
```
node *new_node = malloc(sizeof(node));
if (new_node == NULL)
{
    unload();
    return false;
}
```

make a new word

□ copy word into node

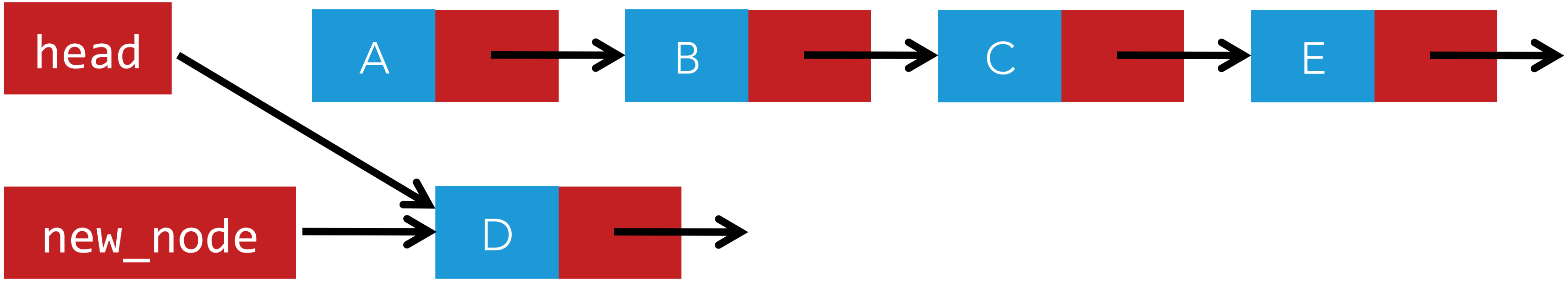
```
strcpy(new_node->word, word);
```

insert into a linked list: incorrect



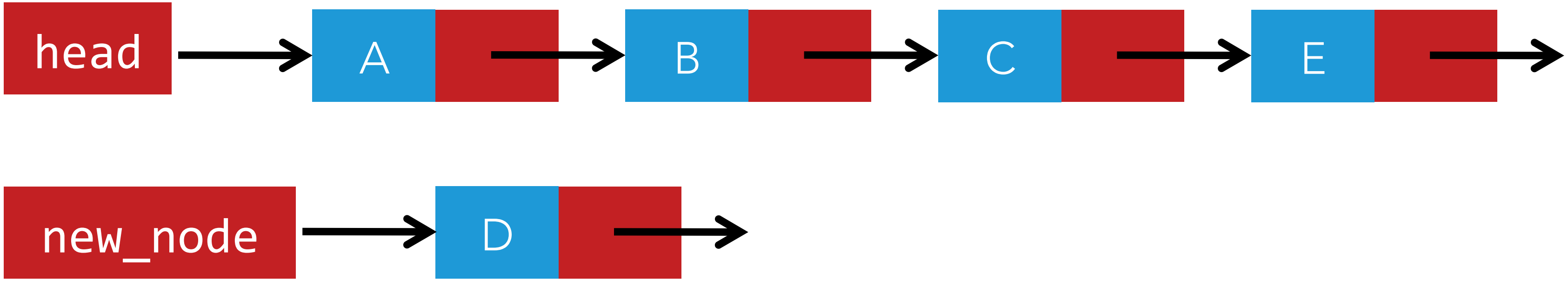
```
head = new_node;
```

insert into a linked list: incorrect



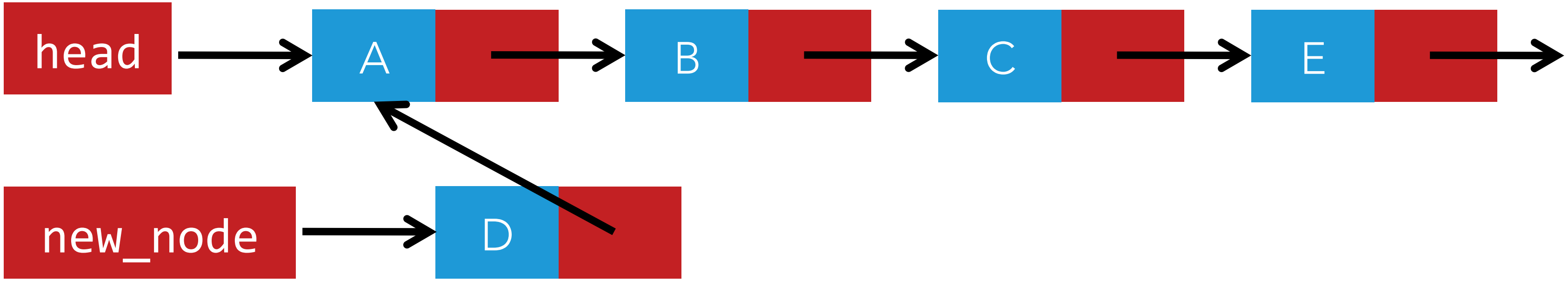
```
head = new_node;
```

insert into a linked list: correct



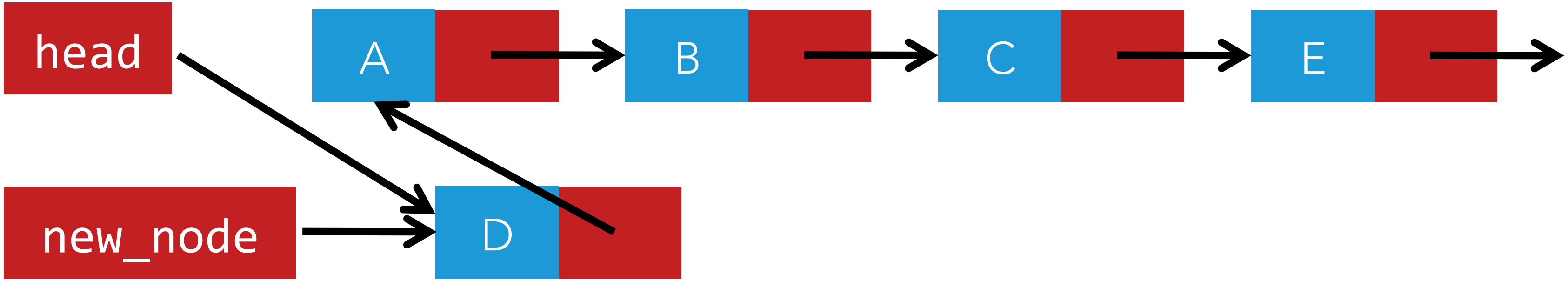
```
new_node->next = head;
```

insert into a linked list: correct



```
new_node->next = head;
head = new_node;
```

insert into a linked list: correct



```
new_node->next = head;
head = new_node;
```

hash function

- takes a string
- returns an index
  - index < the number of buckets
- deterministic
  - the same value needs to map to the same bucket every time

hash the word

- `new_node->word` has the word from the dictionary
- hashing `new_node->word` will give us the index of a bucket in the hash table
- insert into the linked list

a hash table is
an array of linked lists

each element of array is a node *

tries

- every node contains an array of node pointers
  - one for every letter in the alphabet + `'\''`
  - each element in the array points to another node
    - if that node is `NULL`, then that letter isn’t the next letter of any word in that sequence
- every node indicates whether it’s the last character of a word

tries

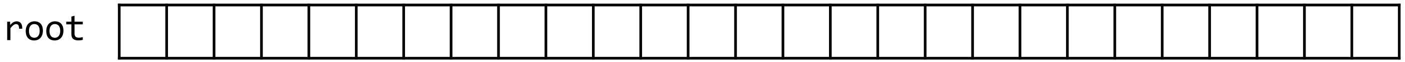
```
typedef struct node
{
     bool is_word;
     struct node *children[27];
}
node;

node *root;
```

`load`

- for every dictionary word, iterate through the trie
- each element in `children` corresponds to a different letter
- check the value at `children[i]`
  - if `NULL`, `malloc` a new node, have `children[i]` point to it
  - if not `NULL`, move to new node and continue
- if at end of word, set `is_word` to `true`

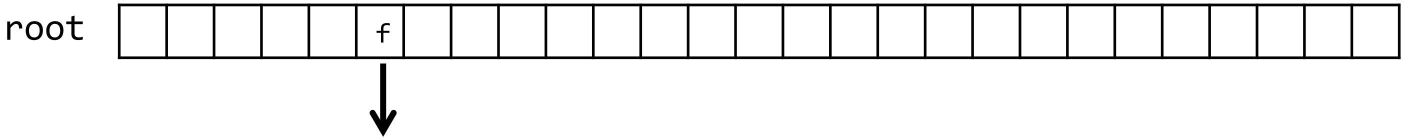
"fox"

```
f: root->children[5]
```



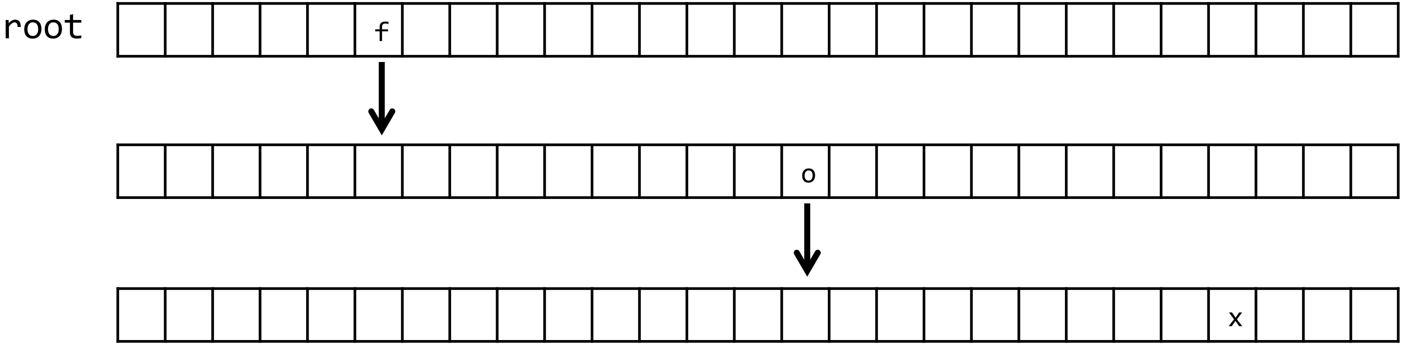
"fox"

```
f: root->children[5]
```



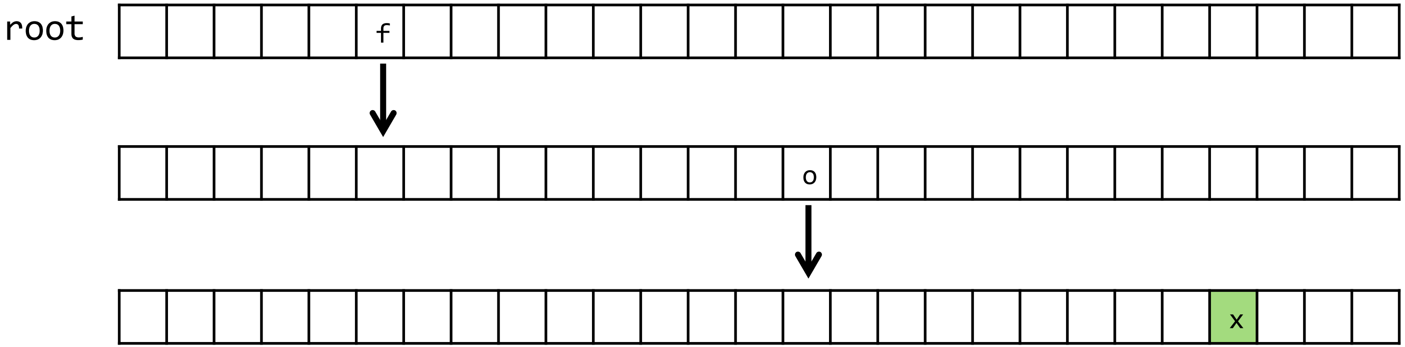
"fox"

```
f: root->children[5]
o: root->children[5]->children[14]
x: root->children[5]->children[14]->children[23]
```



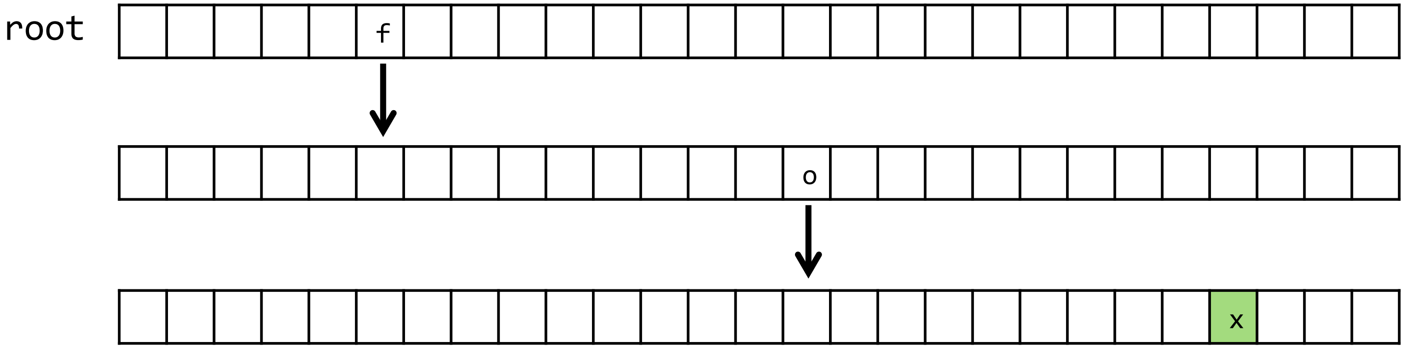
"fox"

```
f: root->children[5]
o: root->children[5]->children[14]
x: root->children[5]->children[14]->children[23]
```



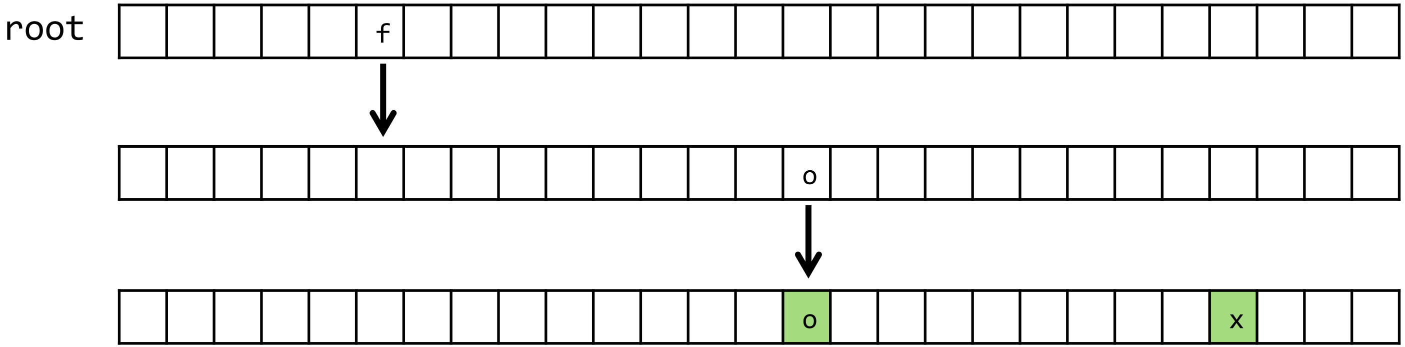
"foo"

```
f: root->children[5]
o: root->children[5]->children[14]
o: root->children[5]->children[14]->children[14]
```



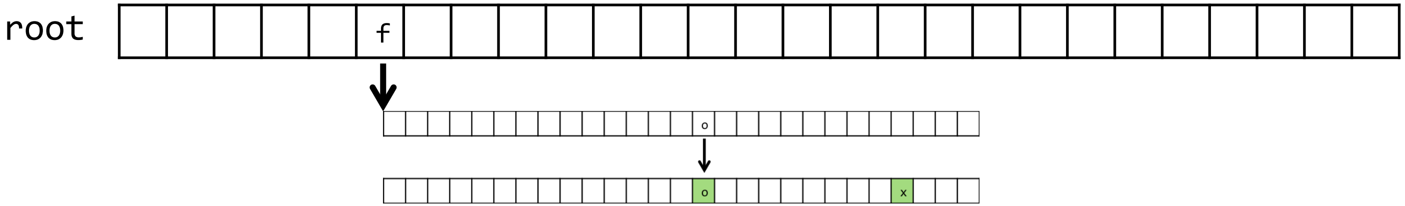
"foo"

```
f: root->children[5]
o: root->children[5]->children[14]
o: root->children[5]->children[14]->children[14]
```



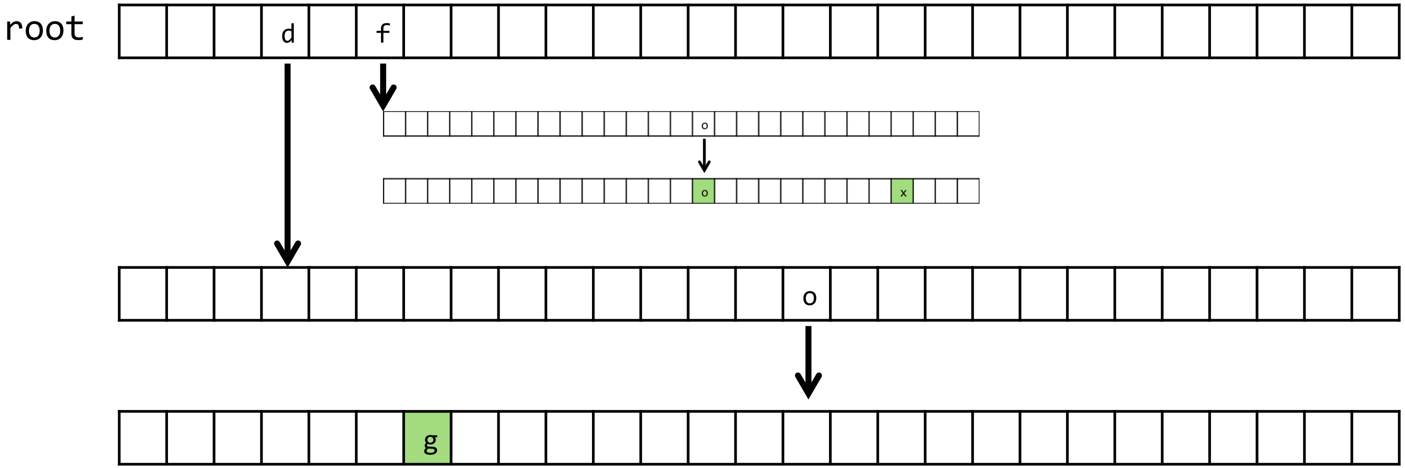
"dog"

d: root->children[3]



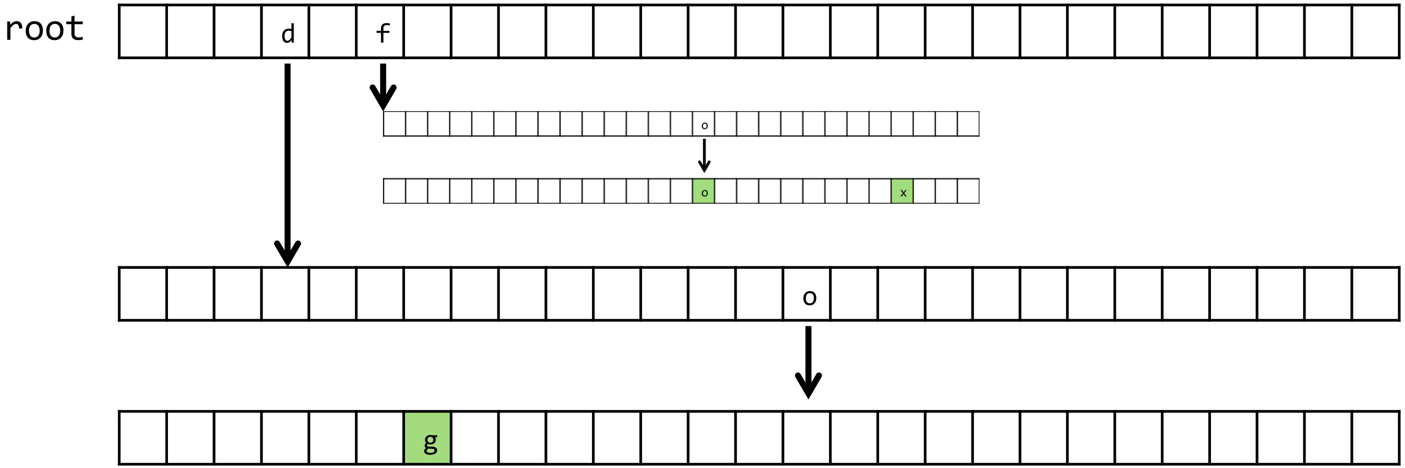
"dog"

```
d: root->children[3]
o: root->children[3]->children[14]
g: root->children[3]->children[6]
```



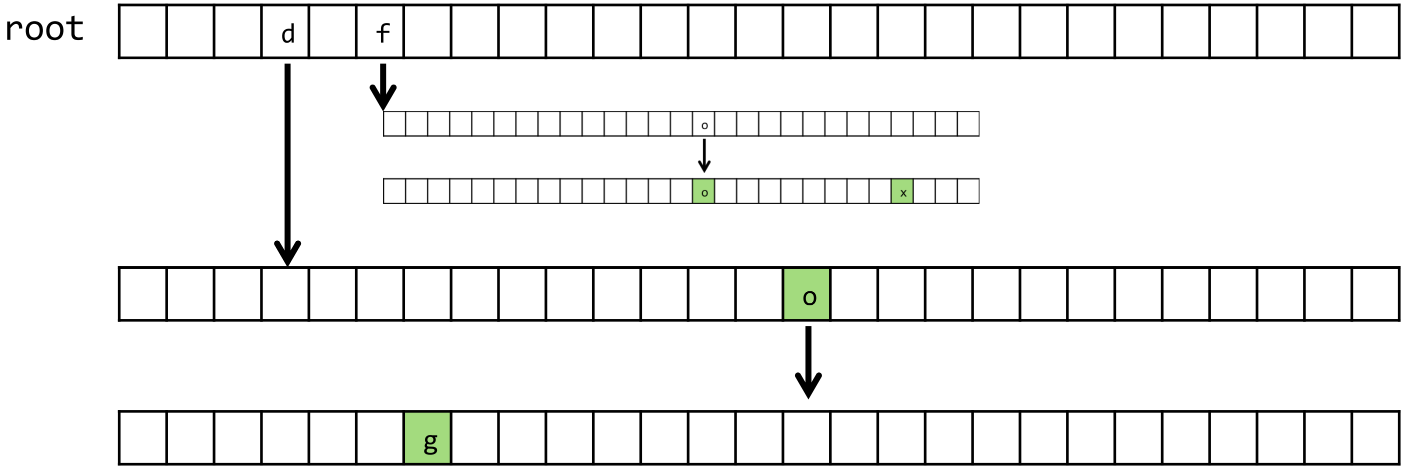
"do"

```
d: root->children[3]
o: root->children[3]->children[14]
```



"do"

```
d: root->children[3]
o: root->children[3]->children[14]
```


root
d
f
o
o
x
o
g