Computer Science 50

Introduction to Computer Science I

Harvard College

Week 6

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CS 50's Library
Revisited

- `bool`
- `string`

- `char GetChar();`
- `double GetDouble();`
- `float GetFloat();`
- `int GetInt();`
- `long long GetLongLong();`
- `string GetString();`

see
`~cs50/pub/releases/cs50/cs50.{c,h}`

Singly Linked Lists

```
typedef struct _node
{
    int n;
    struct _node *next;
}
node;
```

see
`list1.{c,h}`

Singly Linked Lists

```
typedef struct
{
    int id;
    char * name;
    char * house;
}
student;

typedef struct _node
{
    student * student;
    struct _node *next;
}
node;
```

see
`list2.{c,h}`

Singly Linked Lists

Representation

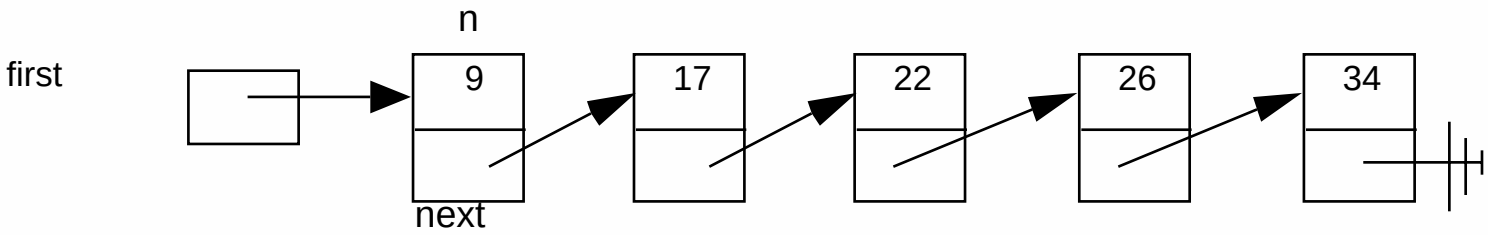

Figure adapted from http://cs.calvin.edu/books/c++/ds/1e/.

Singly Linked Lists

Traversal

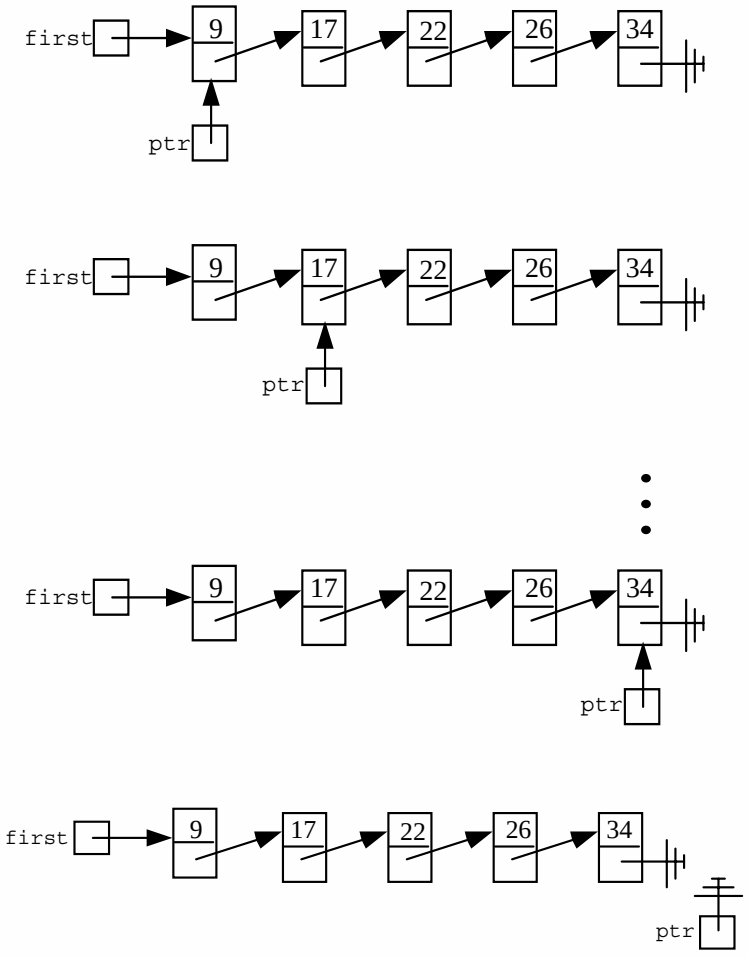

Figure from http://cs.calvin.edu/books/c++/ds/1e/.

Singly Linked Lists

Insertion in Middle: Step 1

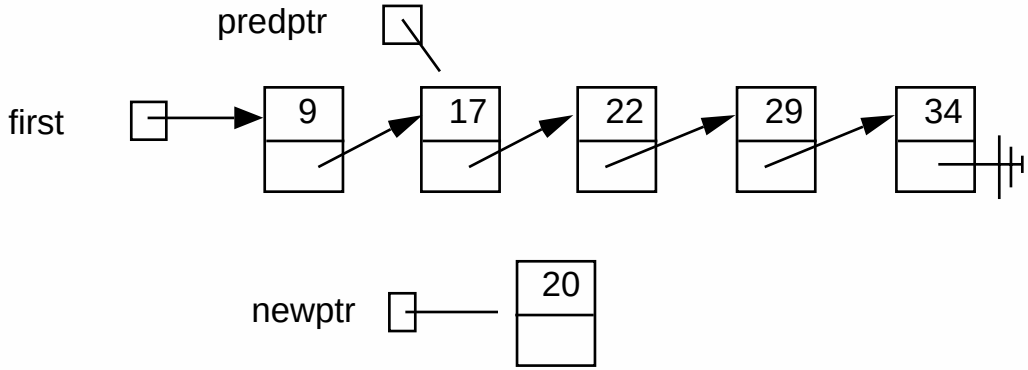

Figure from http://cs.calvin.edu/books/c++/ds/1e/.

Singly Linked Lists

Insertion in Middle: Step 2

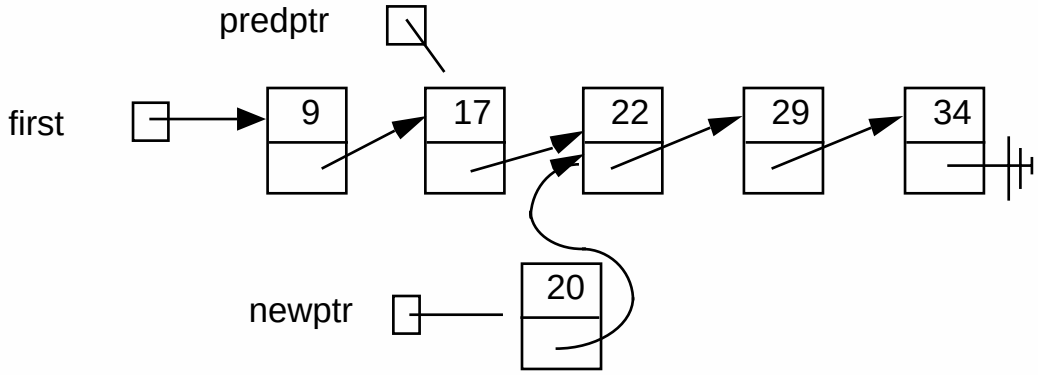

Figure from http://cs.calvin.edu/books/c++/ds/1e/.

Singly Linked Lists

Insertion in Middle: Step 3

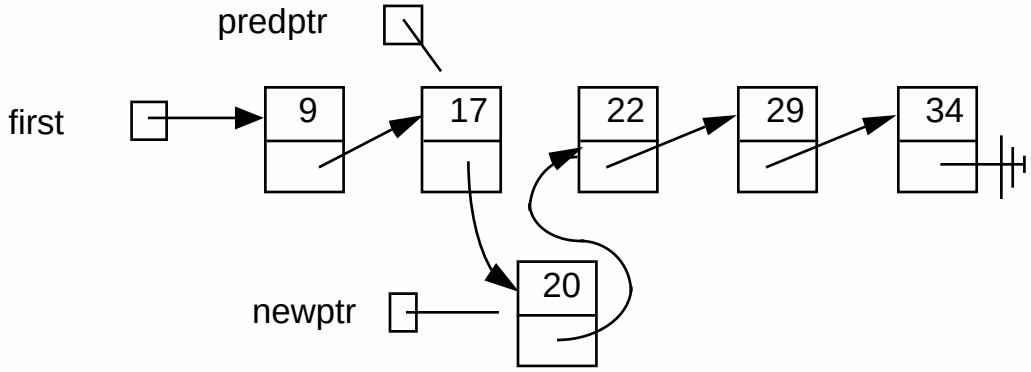

Figure from http://cs.calvin.edu/books/c++/ds/1e/.

Singly Linked Lists

Insertion at Tail

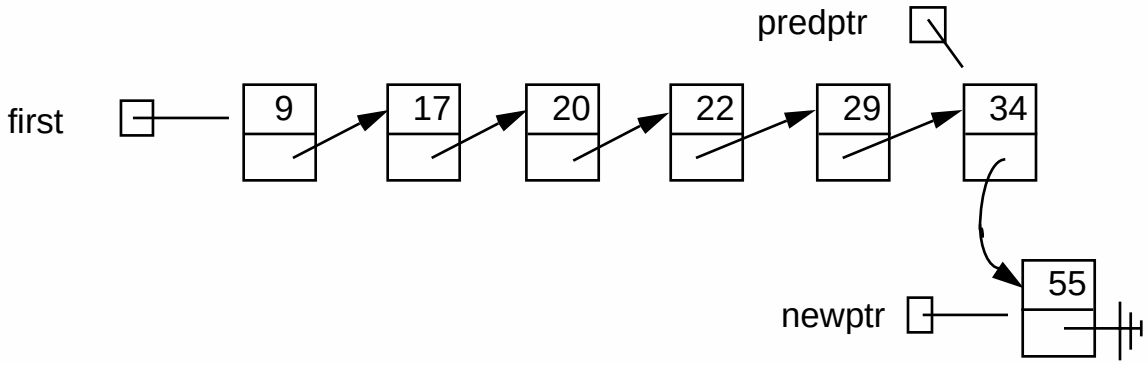

Figure from http://cs.calvin.edu/books/c++/ds/1e/.

Singly Linked Lists

Insertion at Head

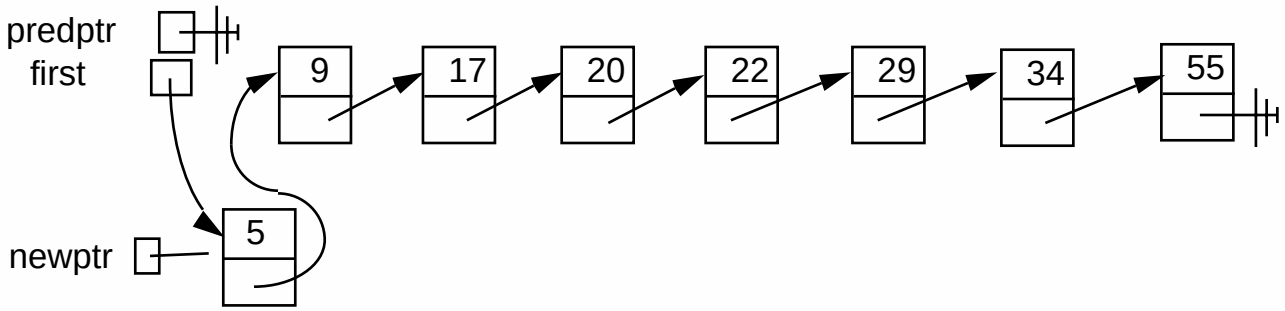

Figure from http://cs.calvin.edu/books/c++/ds/1e/.

Singly Linked Lists

Deletion from Middle

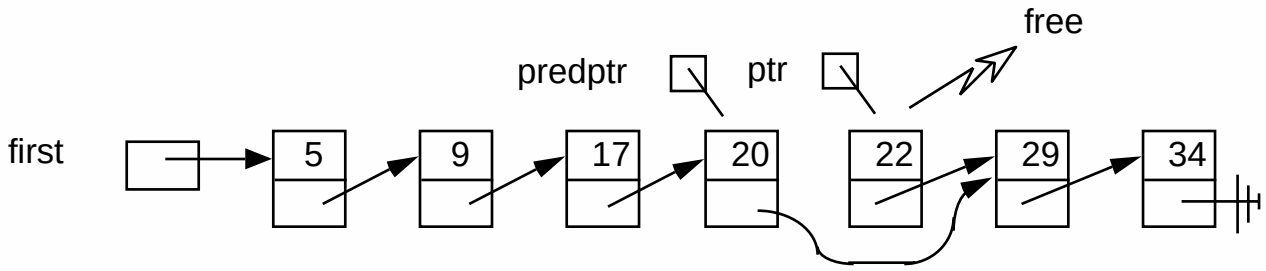

Figure from http://cs.calvin.edu/books/c++/ds/1e/.

Singly Linked Lists

Deletion from Tail

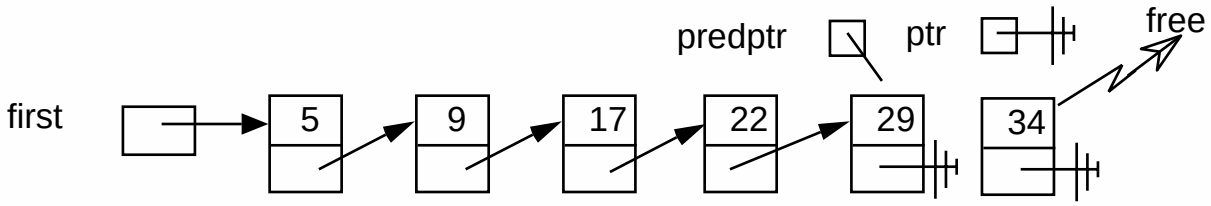

Figure from http://cs.calvin.edu/books/c++/ds/1e/.

Singly Linked Lists

Deletion from Head

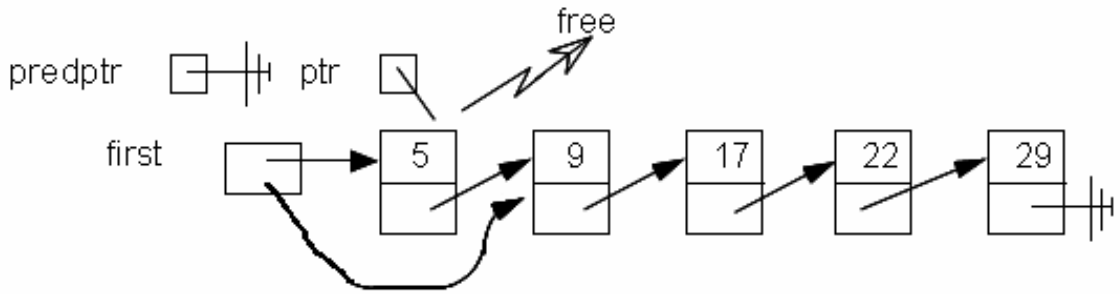

Figure adapted from http://cs.calvin.edu/books/c++/ds/1e/.

Doubly Linked Lists

Representation

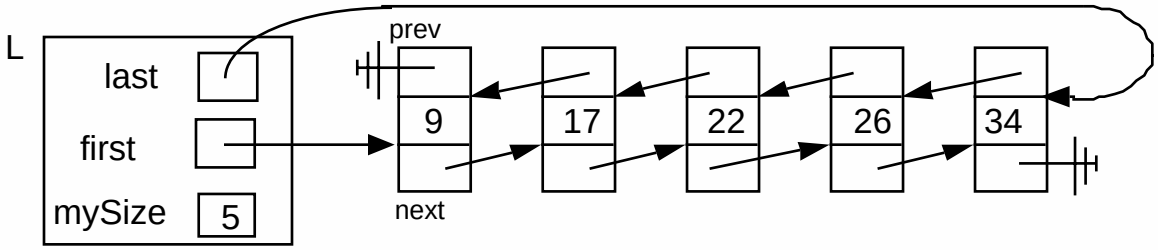

Figure from http://cs.calvin.edu/books/c++/ds/1e/.

Hash Tables

Linear Probing

table[0]	
table[1]	
table[2]	
table[3]	
table[4]	
table[5]	
table[6]	
	. . .
table[24]	
table[25]	

Hash Tables

The Birthday Problem

In a room of *n* CS 50 students,
what's the probability that at least
two students share the same birthday?

Hash Tables

The Birthday Problem

$$\bar{p}(n) = 1 \cdot \left(1 - \frac{1}{365}\right) \cdot \left(1 - \frac{2}{365}\right) \cdots \left(1 - \frac{n-1}{365}\right) = \frac{365 \cdot 364 \cdots (365 - n + 1)}{365^n} = \frac{365!}{365^n (365 - n)!}$$

Image from http://en.wikipedia.org/wiki/Birthday_paradox.

Hash Tables

The Birthday Problem

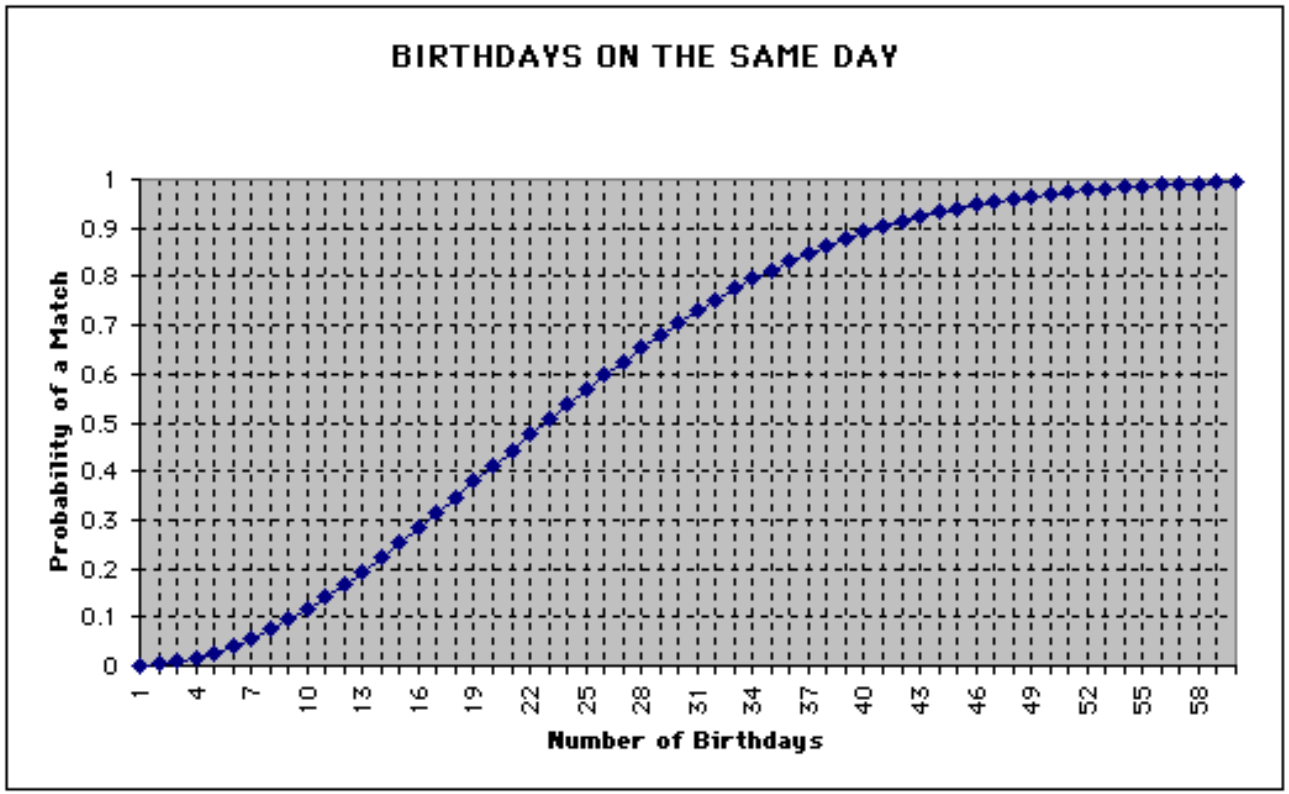

Image from http://www.mste.uiuc.edu/reese/birthday/probchart.GIF.

Hash Tables

Coalesced Chaining

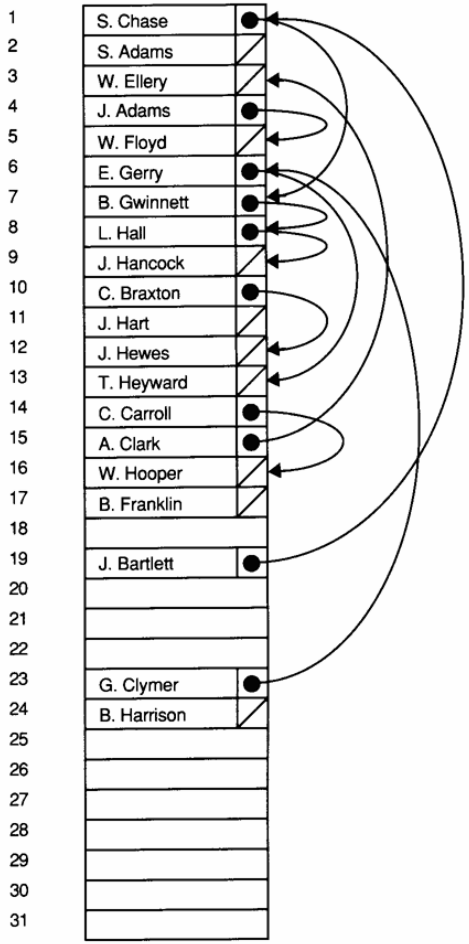

Figure from Lewis and Denenberg's *Data Structures & Their Algorithms*.

Hash Tables

Separate Chaining

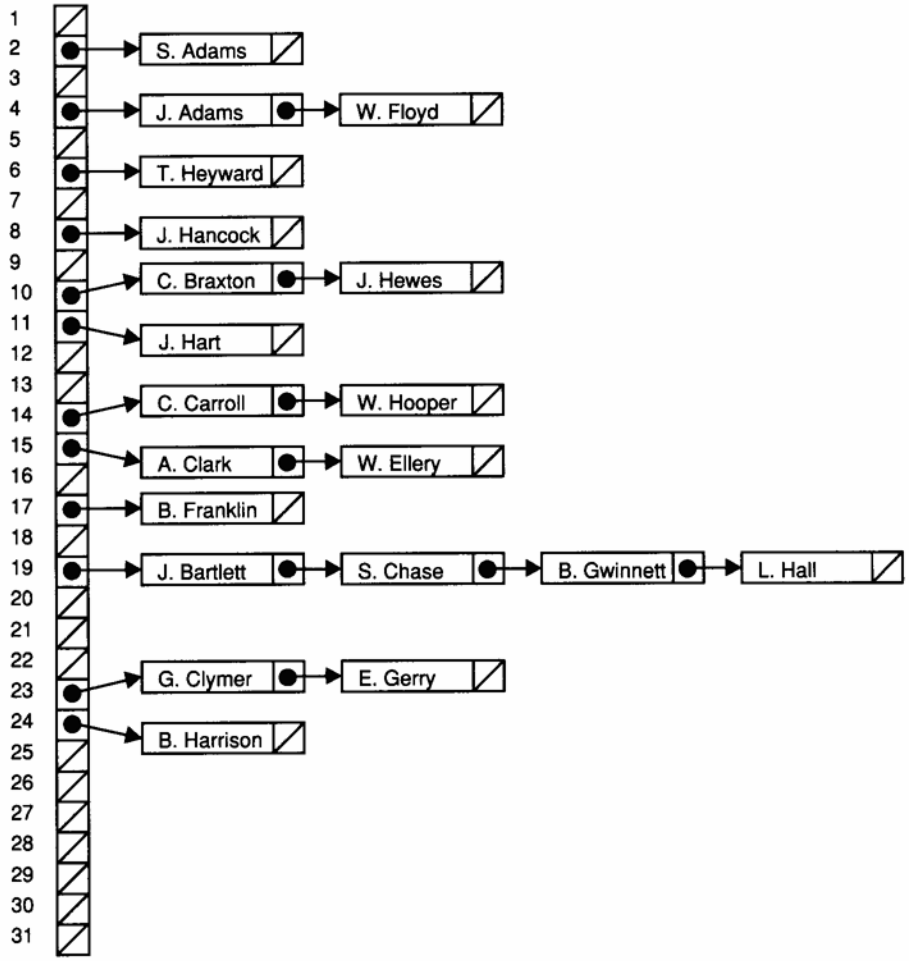

Figure from Lewis and Denenberg's *Data Structures & Their Algorithms*.

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