This is CS50.

100,000

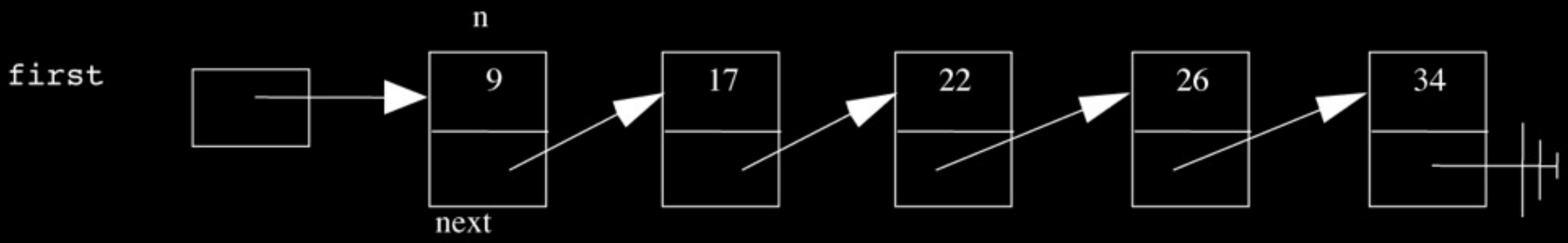
x.cs50.net/ca

valgrind

```
valgrind -v --leak-check=full ./a.out
```

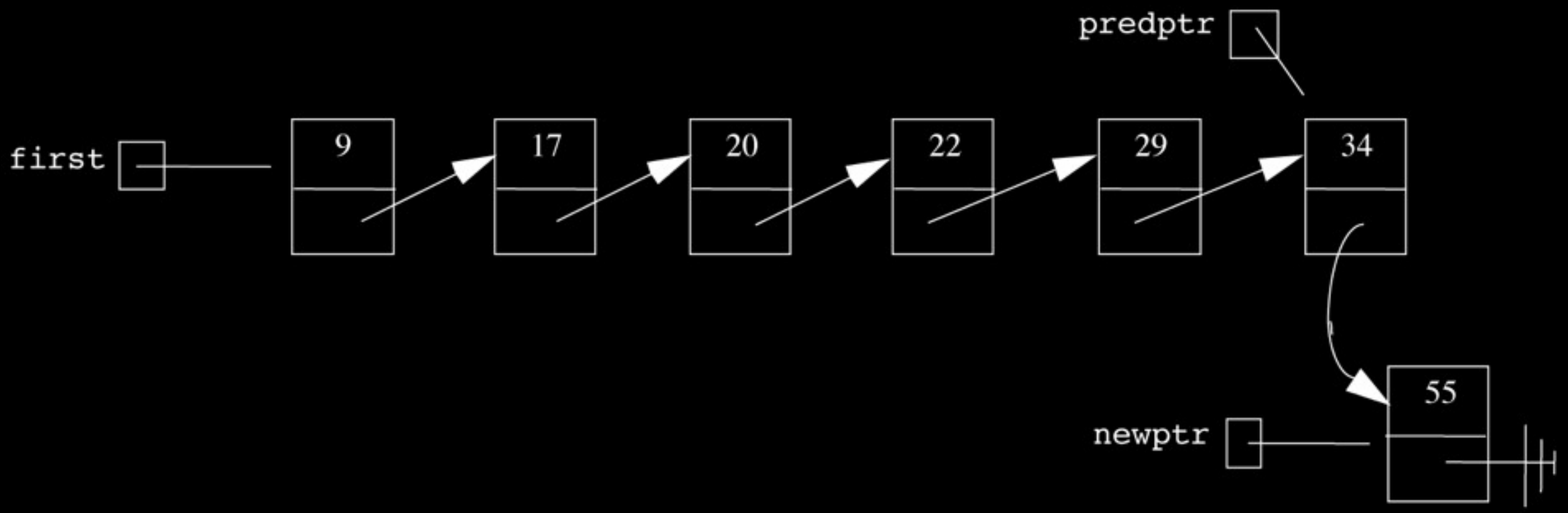
```
Invalid write of size 4
   at 0x80484A0: f (memory.c:21)
   by 0x80484C1: main (memory.c:26)

40 bytes in 1 blocks are definitely lost in loss record 1 of 1
   at 0x402A059: malloc (vg_replace_malloc.c:263)
   by 0x8048499: f (memory.c:20)
   by 0x80484C1: main (memory.c:26)
```



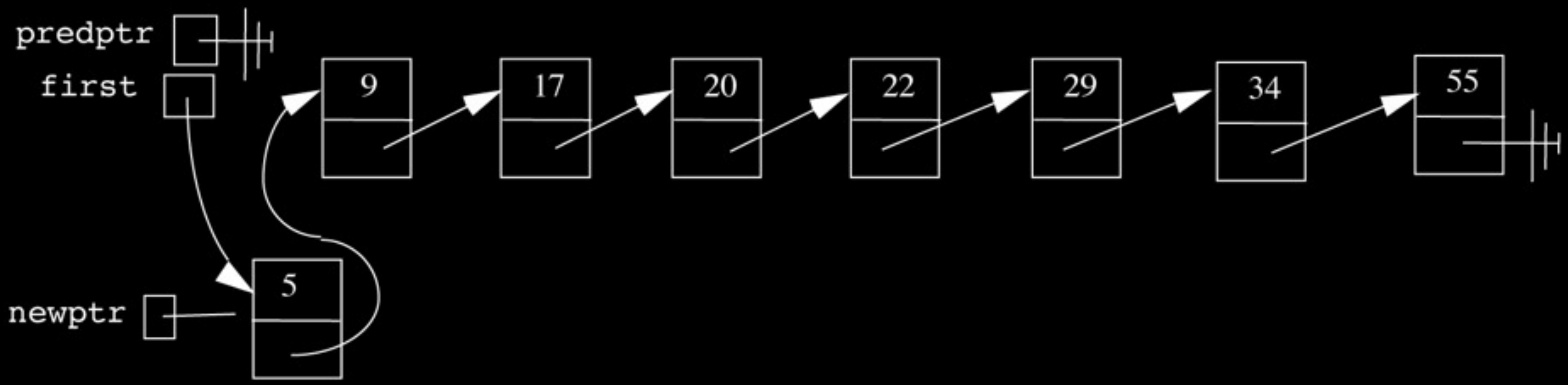
http://cs.calvin.edu/books/c++/ds/1e/

insert at tail



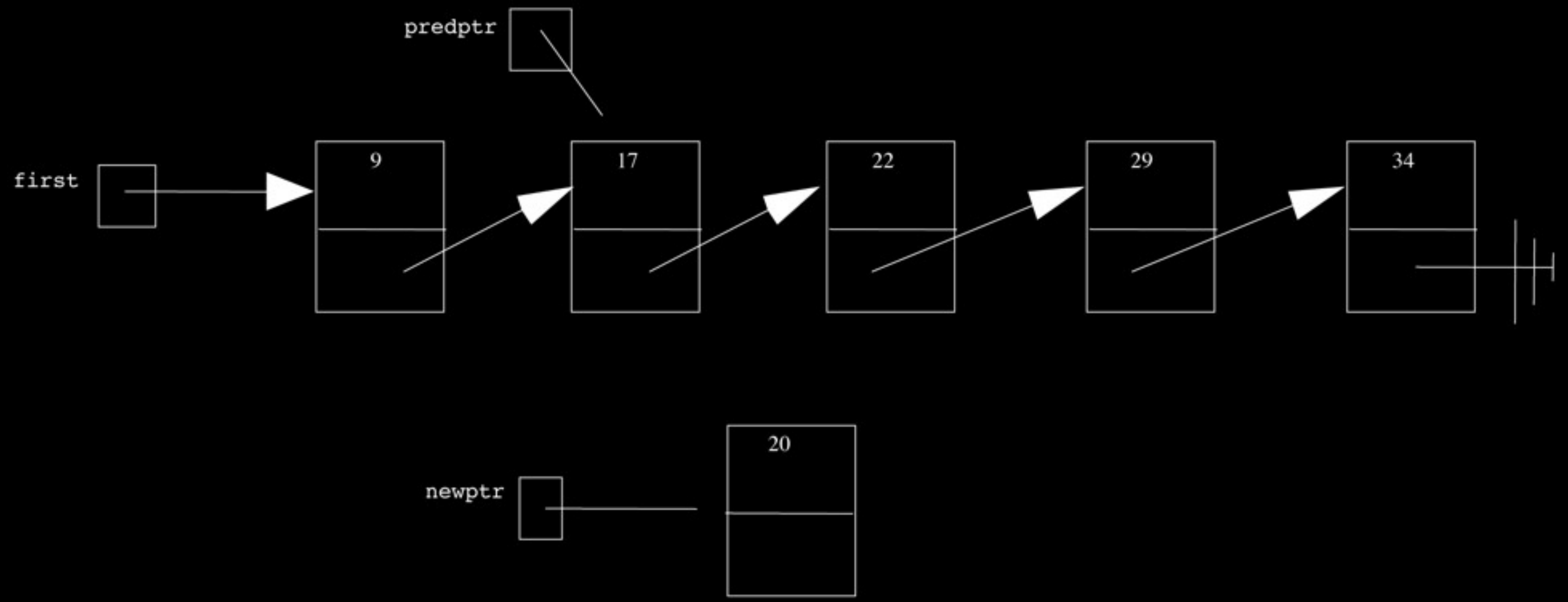
http://cs.calvin.edu/books/c++/ds/1e/

insert at head



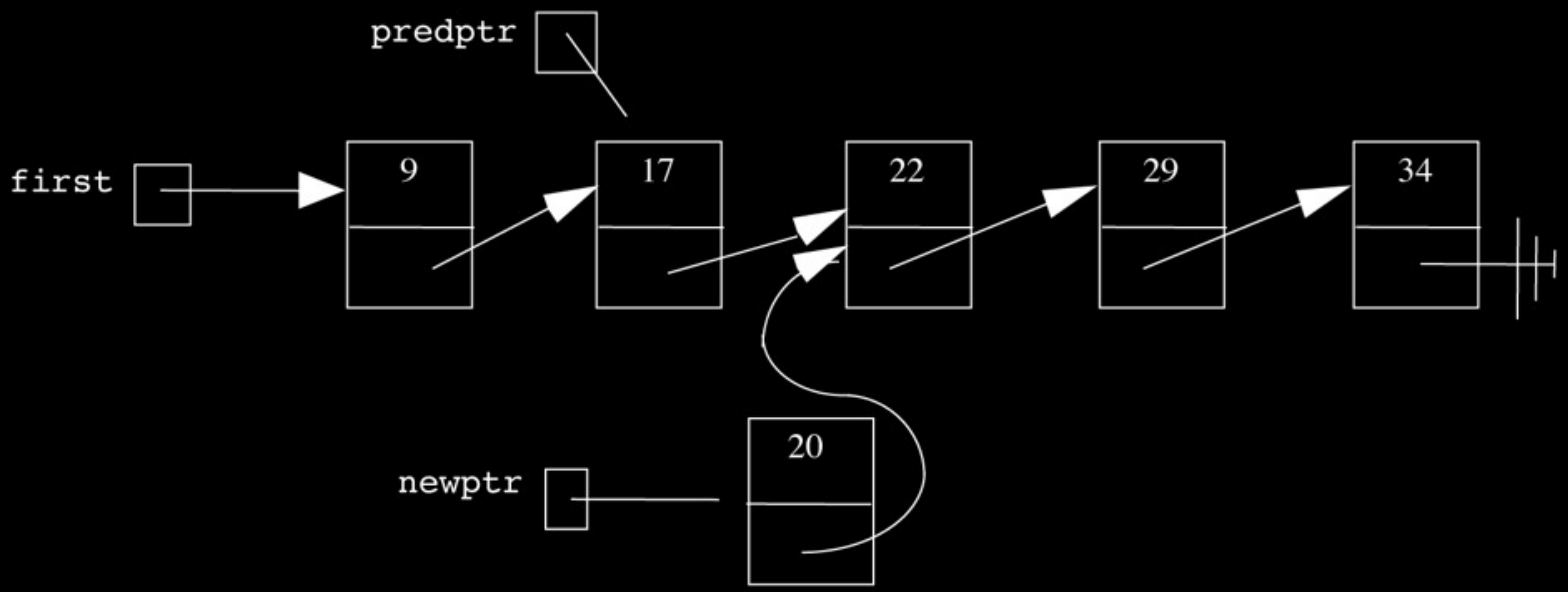
http://cs.calvin.edu/books/c++/ds/1e/

insert in middle



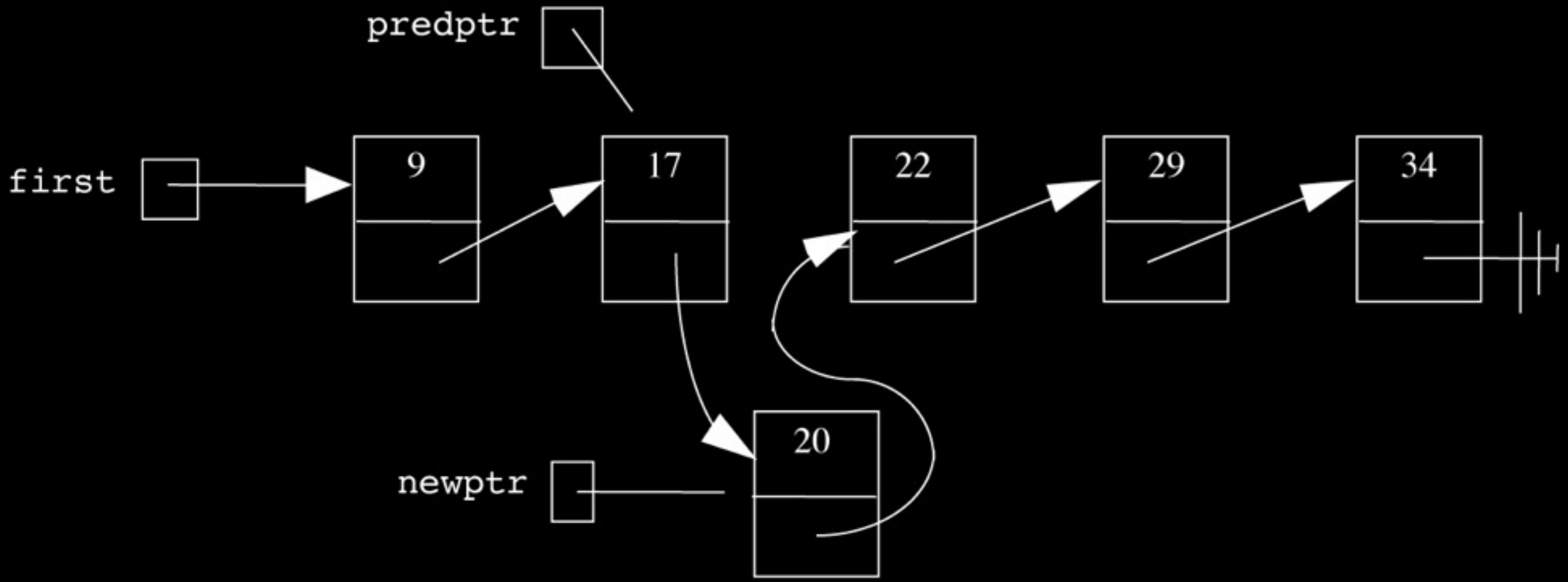
http://cs.calvin.edu/books/c++/ds/1e/

insert in middle



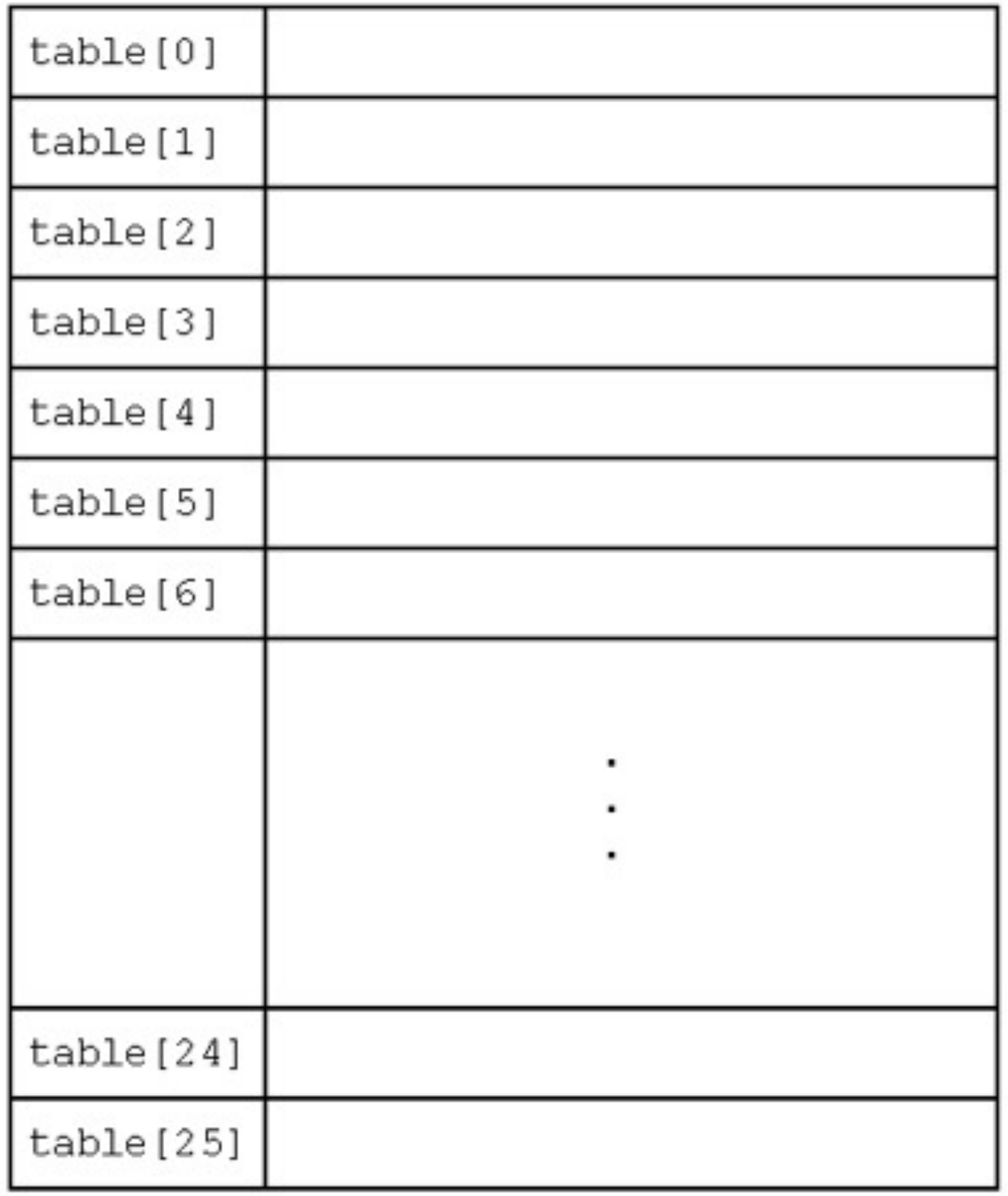
http://cs.calvin.edu/books/c++/ds/1e/

insert in middle



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

hash table



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

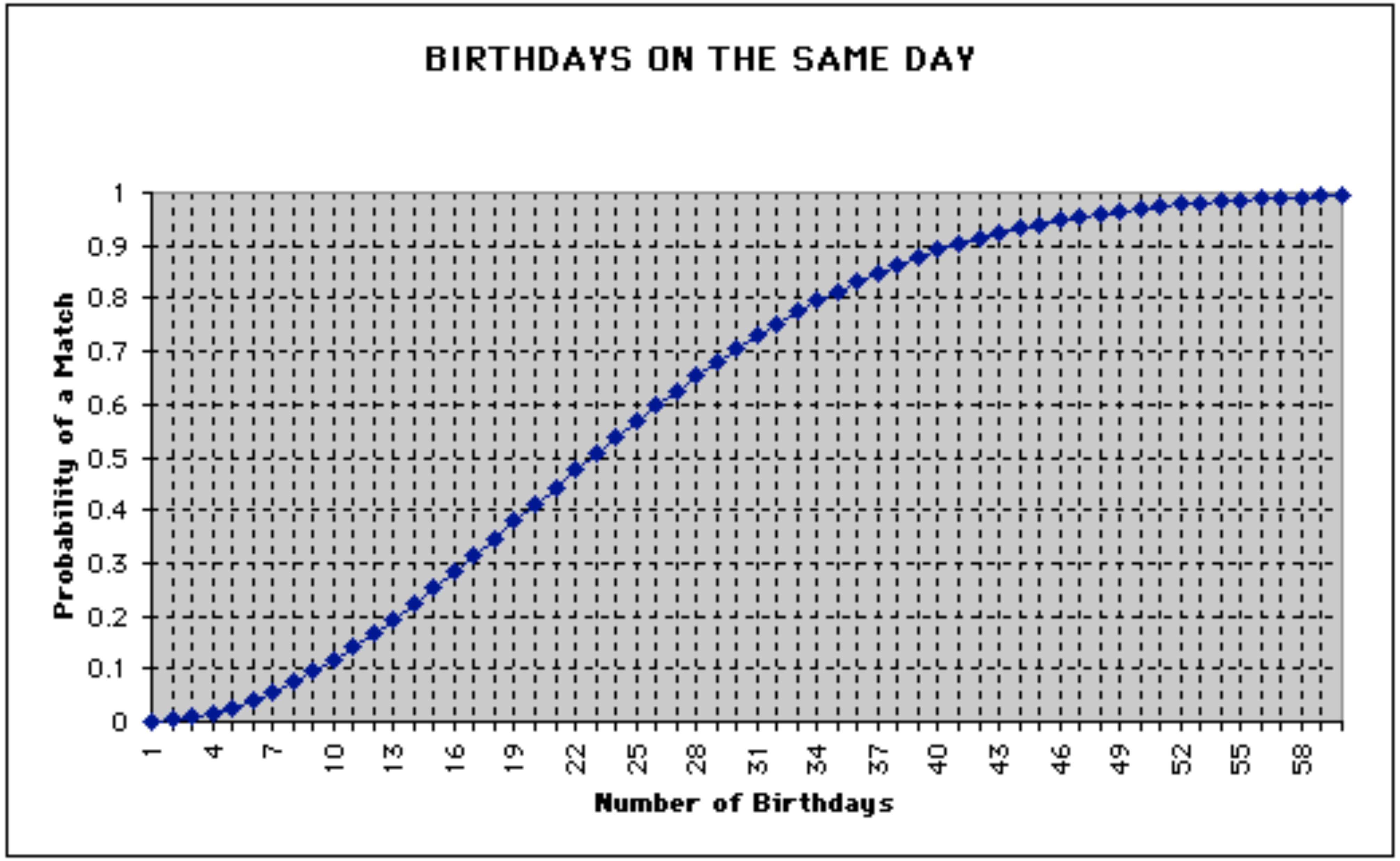
In a room of *n* CS50 students, what’s the probability that at least 2 students have the same birthday?

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

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

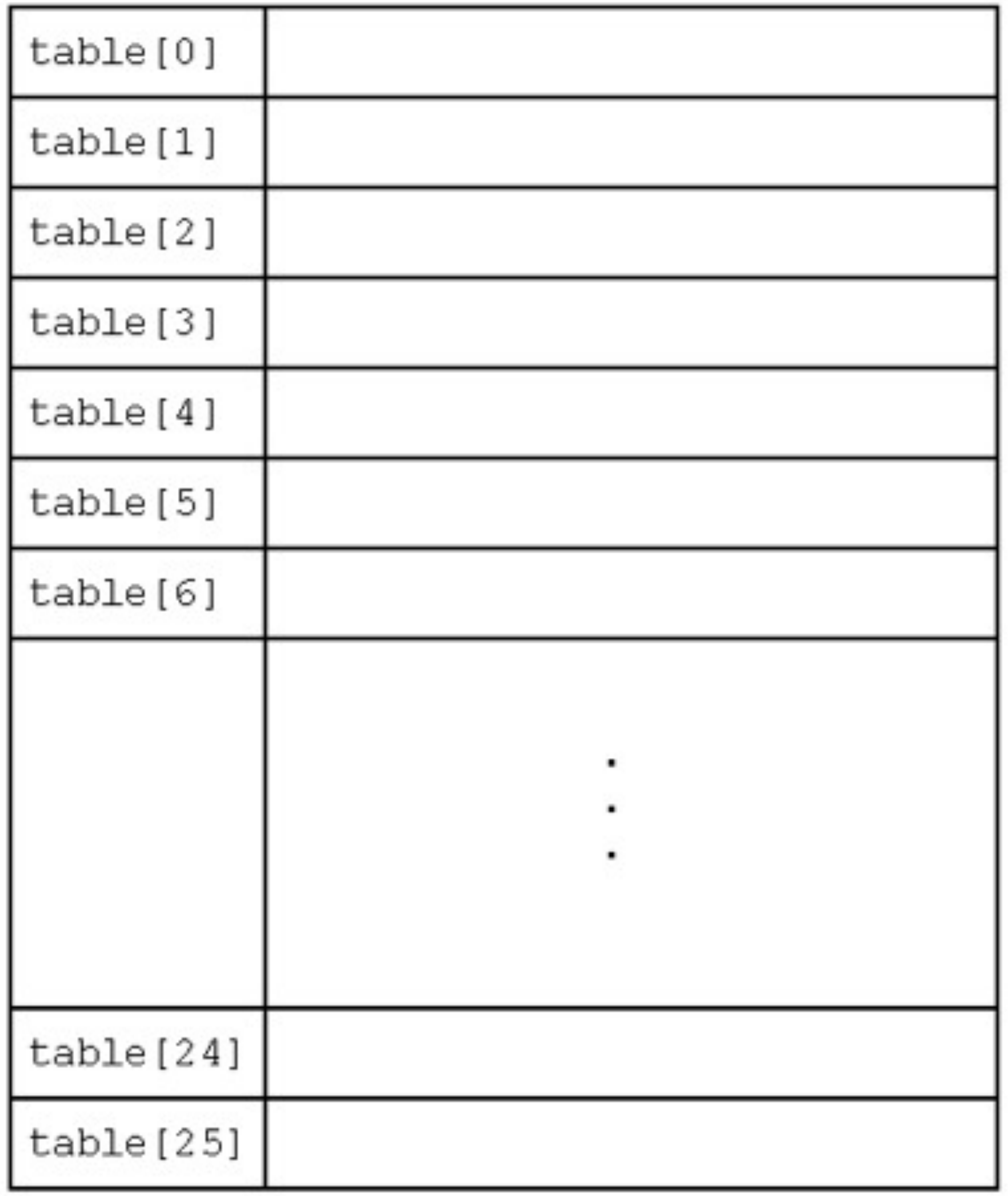
$$= \frac{365!}{365^n(365-n)!}$$

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



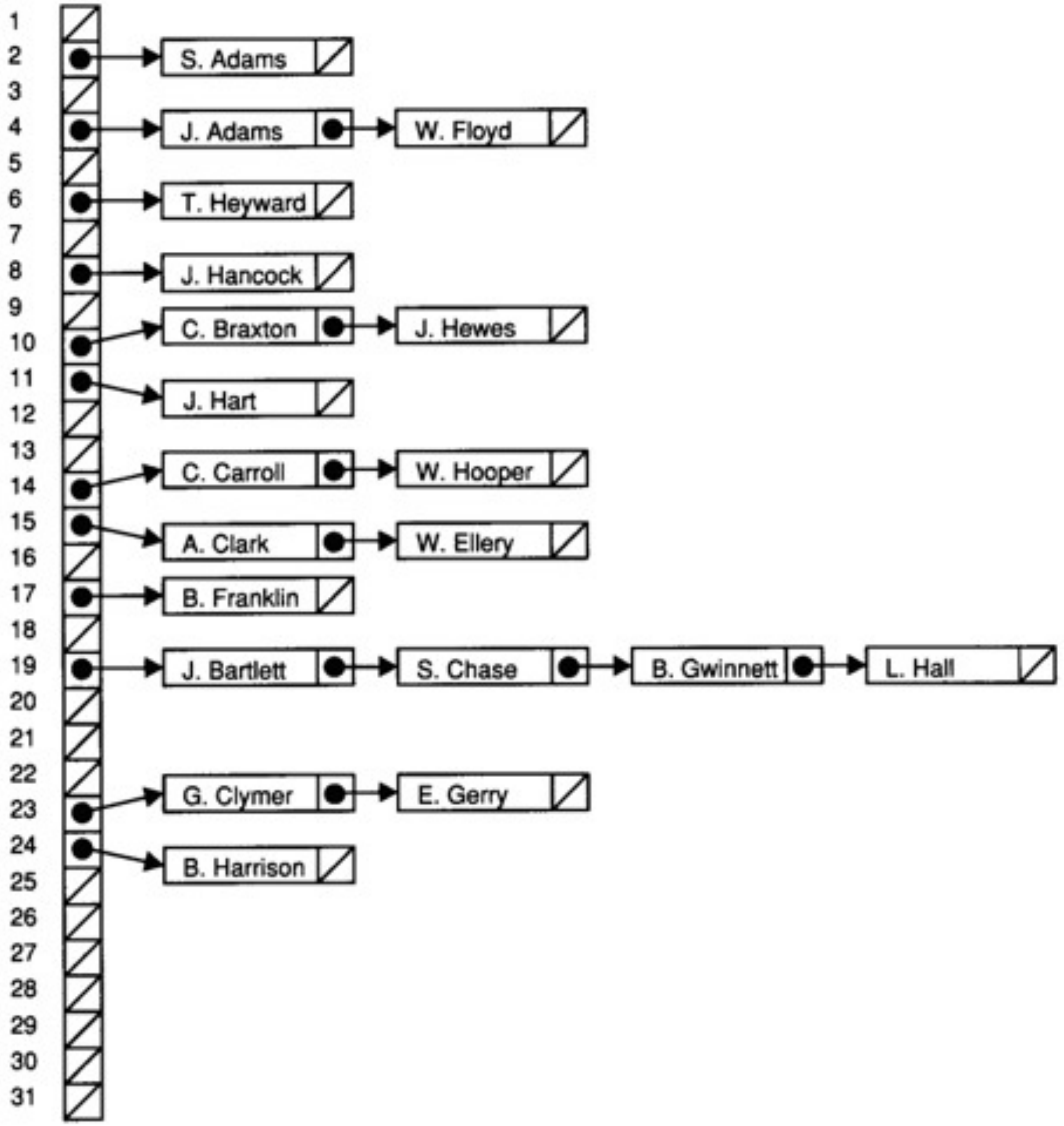
http://www.mste.uiuc.edu/reese/birthday/probchart.GIF

linear probing



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

separate chaining



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

```
node* table[31];
```

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

tree

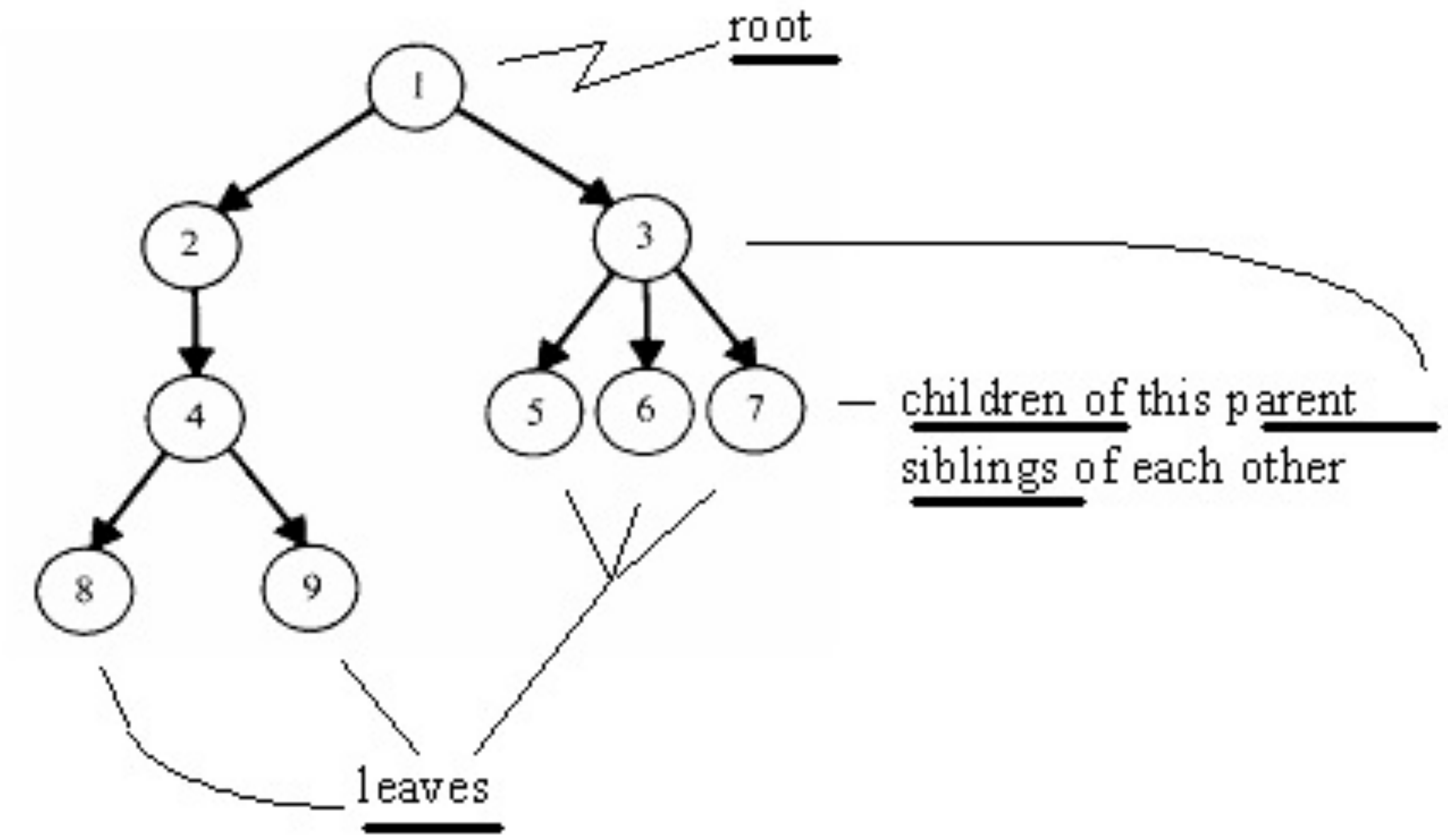
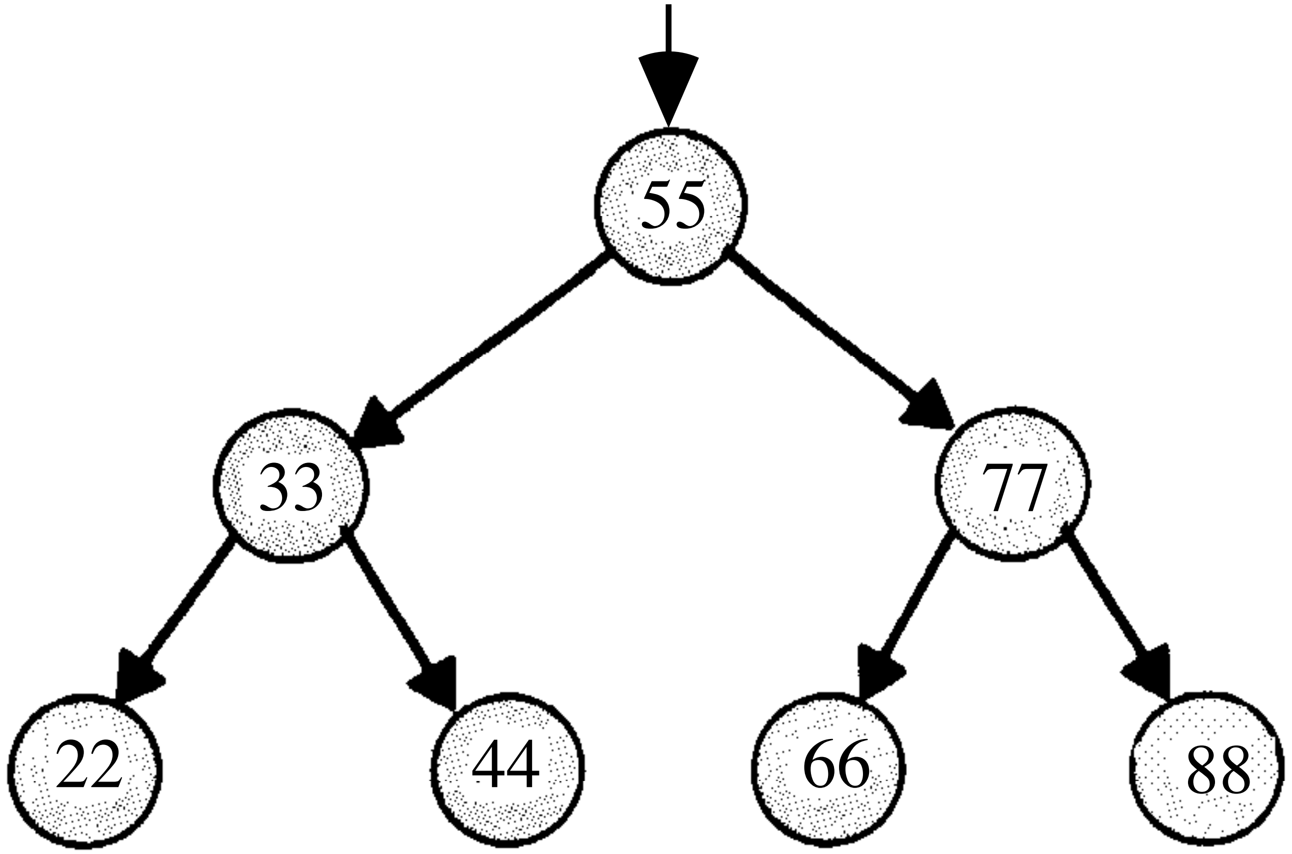


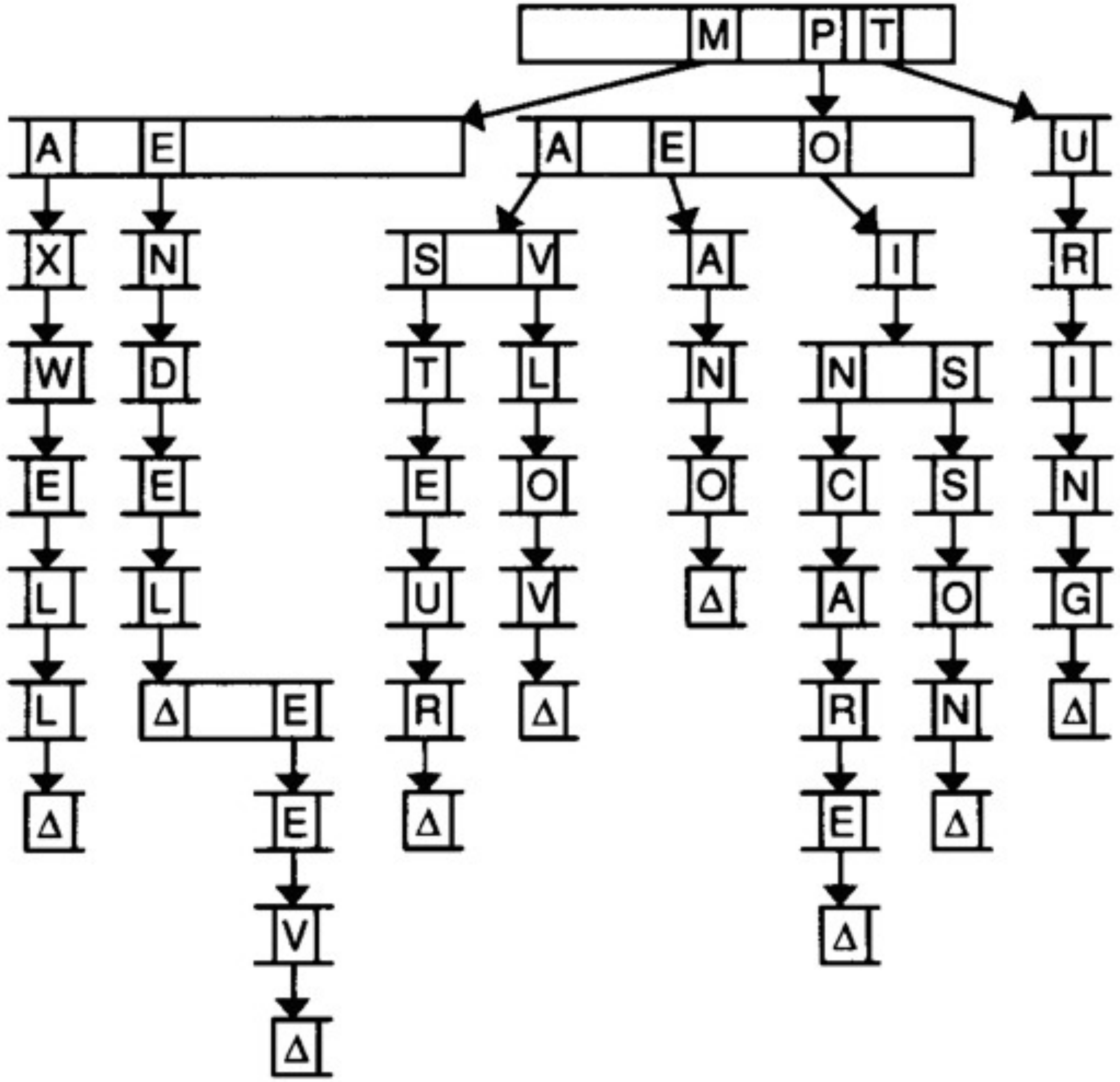
Figure by Larry Nyhoff.

binary search tree



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

```
typedef struct node
{
    int n;
    struct node* left;
    struct node* right;
}
node;
```



Data Structures & Their Algorithms, Lewis and Denenberg

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

http://en.wikipedia.org/w/index.php?title=File:HTML5-logo.svg&page=1

to be continued...