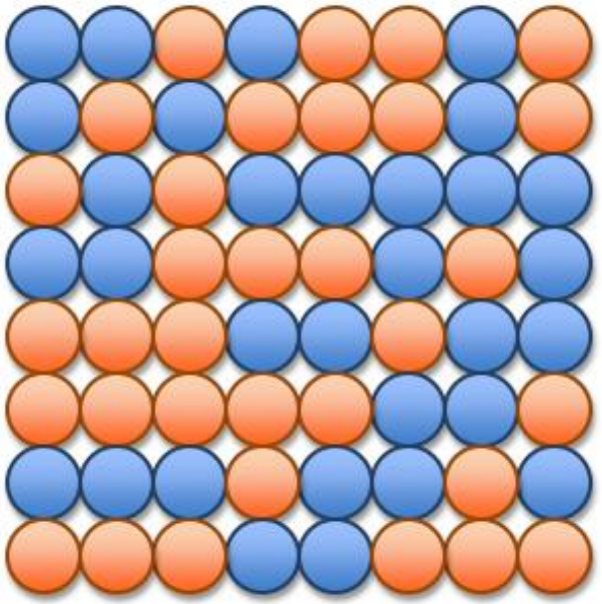
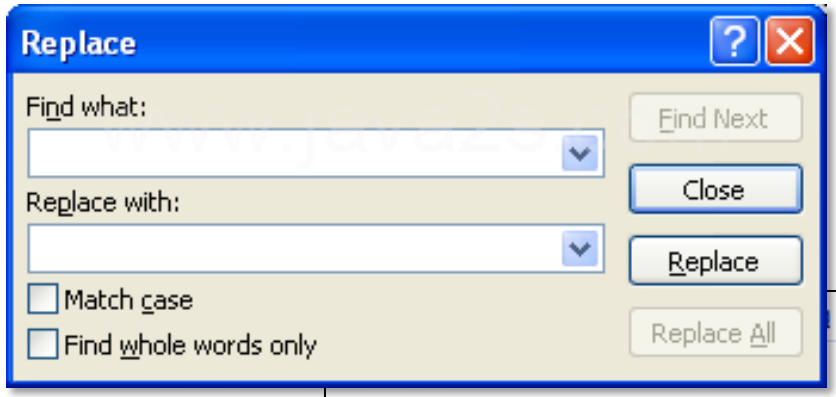


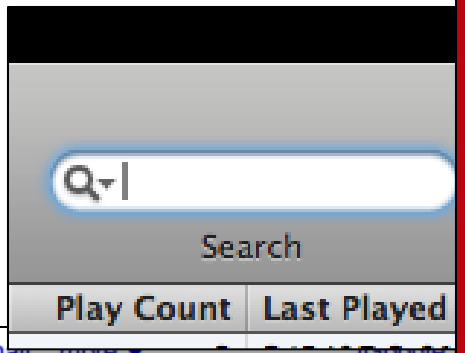
UNIT 4
Searching

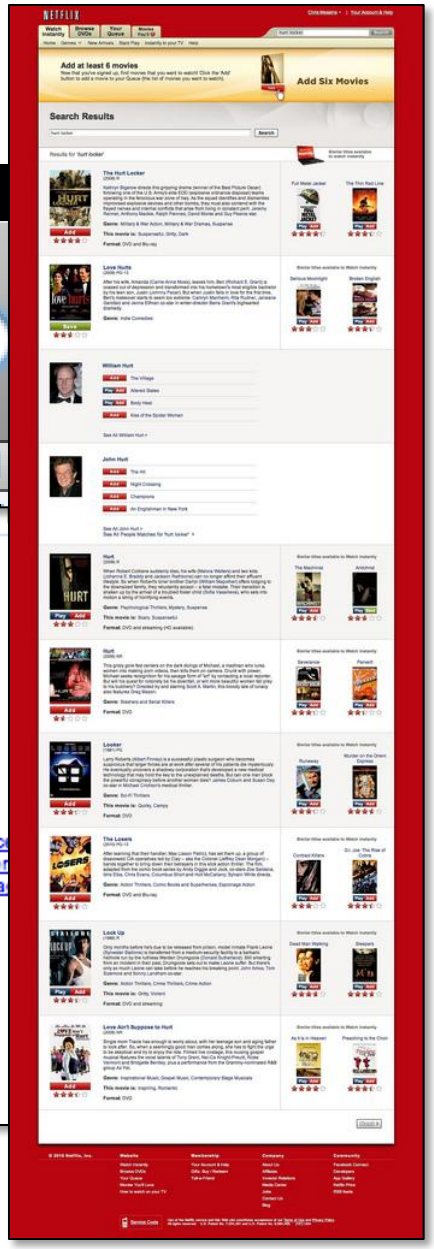
Goals of this Unit

- Study an iterative algorithm called linear search that finds the first occurrence of a target in a collection of data.
- Study an iterative algorithm called insertion sort that sorts a collection of data into non-decreasing order.
- Learn how these algorithm scale as the size of the collection grows.
- Express the amount of work each algorithm performs as a function of the amount of data being processed.

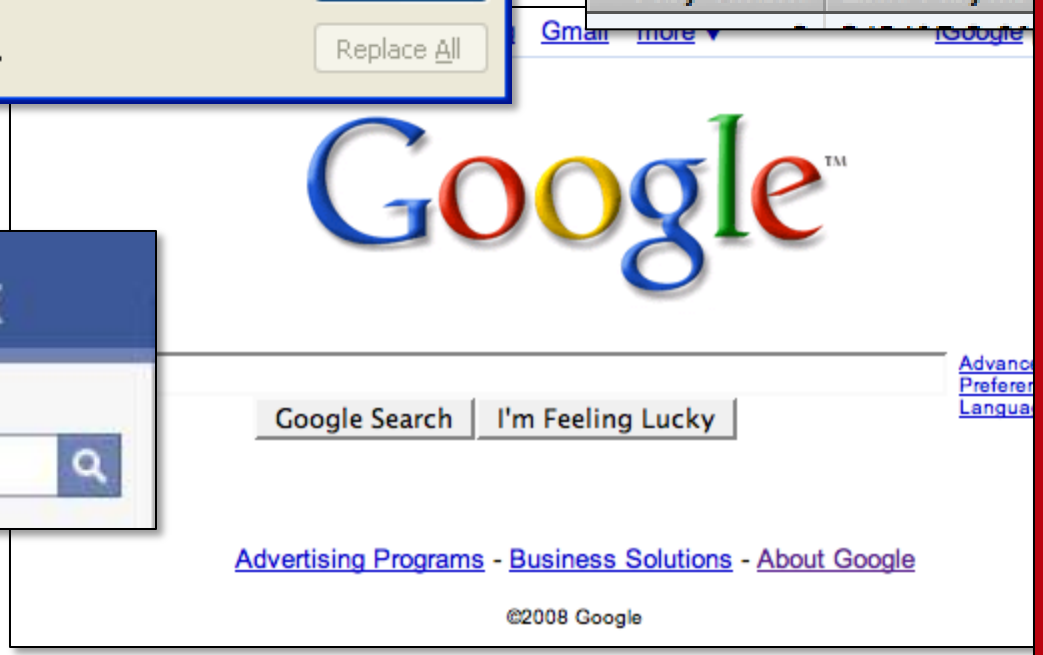
Searching


Replace
Find what:
Replace with:
Match case
Find whole words only
Find Next
Close
Replace
Replace All


Search
Play Count
Last Played


NETFLIX
Add at least 6 movies
Add Six Movies
Search Results


facebook
Search


Gmail
more
Google
Google™
Google Search
I'm Feeling Lucky
Advertising Programs - Business Solutions - About Google
©2008 Google

Built-in Search in Ruby

```
movies = ["up", "wall-e", "toy story",
  "monsters inc", "cars", "bugs life",
  "finding nemo", "the incredibles",
  "ratatouille"]
movies.index("cars")       => 4
movies.index("shrek")      => nil
movies.index("Up")         => nil
movies.include?("wall-e") => true
movies.include?("toy")     => false
```

A Little More about Strings

You can use relational operators to compare strings.

Comparisons are done character by character using ASCII codes.

```
"smithers" > "burns"        => true
"homer" < "marge"           => true
“homer" < “Marge"           => false
"clancy" > "cletus"         => false
"bart" < "bartholomew"      => true
```

Extended ASCII table

1 ┌	33 !	65 A	97 a	129 ▯	161 ¡	193 Á	225 á
2 ┐	34 "	66 B	98 b	130 ‚	162 ¢	194 Â	226 â
3 └	35 #	67 C	99 c	131 ƒ	163 £	195 Ã	227 ã
4 ┘	36 $	68 D	100 d	132 „	164 ¤	196 Ä	228 ä
5 |	37 %	69 E	101 e	133 …	165 ¥	197 Å	229 å
6 ─	38 &	70 F	102 f	134 †	166 ¦	198 Æ	230 æ
7 •	39 '	71 G	103 g	135 ‡	167 §	199 Ç	231 ç
8 ◘	40 (	72 H	104 h	136 ˆ	168 ¨	200 È	232 è
9	41)	73 I	105 i	137 ‰	169 ©	201 É	233 é
10	42 *	74 J	106 j	138 Š	170 ª	202 Ê	234 ê
11 ♂	43 +	75 K	107 k	139 ‹	171 «	203 Ë	235 ë
12 ▫	44 ,	76 L	108 l	140 Œ	172 ¬	204 Ì	236 ì
13	45 -	77 M	109 m	141 ▯	173 -	205 Í	237 í
14 ♫	46 .	78 N	110 n	142 Ž	174 ®	206 Î	238 î
15 ☼	47 /	79 O	111 o	143 ▯	175 ¯	207 Ï	239 ï
16 ►	48 0	80 P	112 p	144 ▯	176 °	208 Ð	240 ð
17 ◄	49 1	81 Q	113 q	145 '	177 ±	209 Ñ	241 ñ
18 ↕	50 2	82 R	114 r	146 '	178 ²	210 Ò	242 ò
19 ‼	51 3	83 S	115 s	147 "	179 ³	211 Ó	243 ó
20 ¶	52 4	84 T	116 t	148 "	180 ´	212 Ô	244 ô
21 §	53 5	85 U	117 u	149 •	181 µ	213 Õ	245 õ
22 ▬	54 6	86 V	118 v	150 –	182 ¶	214 Ö	246 ö
23 ↨	55 7	87 W	119 w	151 —	183 ·	215 ×	247 ÷
24 ↑	56 8	88 X	120 x	152 ˜	184 ¸	216 Ø	248 ø
25 ↓	57 9	89 Y	121 y	153 ™	185 ¹	217 Ù	249 ù
26 →	58 :	90 Z	122 z	154 š	186 º	218 Ú	250 ú
27 ←	59 ;	91 [	123 {	155 ›	187 »	219 Û	251 û
28	60 <	92 \	124 |	156 œ	188 ¼	220 Ü	252 ü
29	61 =	93]	125 }	157 ▯	189 ½	221 Ý	253 ý
30	62 >	94 ^	126 ~	158 ž	190 ¾	222 Þ	254 þ
31	63 ?	95 _	127 ⌂	159 Ÿ	191 ¿	223 ß	255 ÿ
32	64 @	96 `	128 €	160	192 À	224 à	

Containment

Design an algorithm that returns **`true`** if a list contains a desired “key”, or **`false`** otherwise.

A contains? method

```
def contains?(list, key)
  index = 0
  while index < list.length do
     if list[index] == key then
          return true
     end
     index = index + 1
  end
  return false
end
```

What happens if we execute **`return`** before we reach the end of the method?

A contains? method – version 2

```
def contains?(list, key)
  for item in list do
     if item == key then
          return true
     end
  end
  return false
end
```

A contains? method – version 3

```
def contains?(list, key)
  list.each { |item|
     if item == key then
          return true
     end
  }
  return false
end
```

A contains? method – version 4

```
def contains?(list, key)
  list.each { |x| return true if x == key }
  return false
end
```

Important note: You can use this method on keys of any type, as long as the key's type matches the type of the elements in the array.

Search

Design an algorithm that returns the index of the first occurrence of a key in a list if the key is present, or `nil` otherwise.

A **search** method

```
def search(list, key)
  index = 0
  while index < list.length do
     if list[index] == key then
          return index
     end
     index = index + 1
  end
  return nil
end
```

Sorry…

```
def search(list, key)
  for item in list do
     if item == key then
          return index
     end
  end
  return nil
end
```

Why can't we do this?

Ok, but...

```
def search(list, key)
  for item in list do
     if item == key then
          return list.index(key)
     end
  end
  return nil
end
```

What's undesirable about this?