CPSC 131

std::map

Telephone book

How to use a Telephone book?

Waghorne A. E,
Holmscroft Sandford Mill rd.....Cheltenham 4517
Waghorne Bros,Btchrs,346 High st.....Cheltenham 2956
Waghorne D. E,12 Pittville villas.....Cheltenham 3594
Waghorne Frank,Btchr,4 Tivoli bldgs...Cheltenham 3419
Waghorne & Evans,Motr Engrs,
Shurdington rd.....Cheltenham 3211
Waghorne Mrs. M. A,
1 Oxford villas London rd.....Cheltenham 2411
Waghorne Wallace,
Beulah ho 82 Prestbury rd.....Cheltenham 3596
Wagner Mrs. O. H,Spencer cottage
Cirencester rd Minchinhampton....Brimscombe 170
Wagon & Horses Hotel,Hucclecote....Gloucester 614211
Wagon Repairs Ltd,India rd.....★Gloucester 2225
Lydney.....Lydney 73
Waine W. O,Irnmgr,Fountain st.....Nailsworth 83
Waite Mrs. A. E,Church hlg Highnam...Gloucester 3819
Waite A. F,29 Derby rd.....★Gloucester 3301
Waite Eric,Dntl Srgn,9 Imperial sq....Cheltenham 2988
Waite & Son,Twlrs,349 High st.....Cheltenham 2891
Waite T. Wilfred,Engelberg.....⊙Cleeve Hill 72
Wake Mrs.H,10 Imperial sq.....Cheltenham 5140
Wake H. B, L,Newick ho Sandford rd...Cheltenham 4162
Wakefield H. E,13 Park pl.....Cheltenham 4583
Wakefield Mrs. L,10 Church st.....Cheltenham 4532
Wakefield Miss M. C,
Camperdown St Stephens rd.....Cheltenham 3407
Wakefield Mrs. M. R,Spring Hill ct.....Nailsworth 105
Wakefield & Son,Tlrs,Market pl.....Cirencester 119
Wakefield Thomas,Church farm.....Northleach 49
Wakeford E. E,Plmbr, Hot-Water Fttr,
Edwy parade.....Gloucester 2952
Walden F,Btchr,26 Dyer st.....Cirencester 191
Wales Sydney,
Hyde Tyning Minchinhampton....Brimscombe 130
Wales Sydney,Quarns Minchinhampton..Brimscombe 201
Walford Miss E. M,
Royal Well villa Chapel walk.....Cheltenham 3958
Walford S. T,Uphill 189 Leckhampton rd Cheltenham 2839
Walker Mrs. A,Sub Postmistress PO.....Culkerton 1
Walker A. A,Church ho Naunton.....Guiting Power 29
Walker A. J,Bkr,Confctnr,17 Leeg st..Wotton-u-E 123
Walker A. W,Btchr,Kemerton nr Tewkesbury Bredon 6
Walker Mrs. C. F,The Mount.....Amberley 43
Walker Col. C. W. G,Manor ho.....South Cerney 10
Walker & Co's Strs Ltd,Grcrs,George st....Stroud 125
Walker & Co.'s Strs,Castle st.....Cirencester 84
Walker E. W, Berry Wormington.....Toddington 2
Walker Mrs. Gavin,7 Queens parade....Cheltenham 4967
Walker George N,Norton ct Glostr.....Twigworth 6x
Walker G. S,Hardwicke ho.....Bredon 7
Walker Harry,High st garMinchinhmptn Brimscombe 73
Walker H. C,Greentrees Hatherley rd...Cheltenham 4962
Walker H. J,Mt Pleasant Stowe.....St. Briavels 29
Walker Lt-Col. H. S,Greenfields..Bourton-on-the-W 21
Walker J,Gent Strs,
Cheltenham rd Gloucester.....⊙Churchdown 357
Walker James,
Honeyacre Ullenwood Cheltenham...Shurdington 71
Walker James (Goldsmith & Silversmith) Ltd,
43 Promenade.....Cheltenham 3427
Walker Miles,F.R.S,Dunkirk ho.....Amberley 131
Walker R. W,
The Hawthorns Church rd.....Cheltenham 5090
Walker Thos. H,Underhill.....Dursley 159
Walker T. Lawson,Frmr,
Pool fm Acton Beauchamp Worcs.Fromes Hill 17
Walker W. C. & Son,Bkrs,Grcrs,
Chedworth.....Fossebridge 18
Walker W. J,Buscot Wick.....Lechlade 63
Wallis Mrs. M,Avonside.....Tewkesbury 20
Wallis Miss M. J. R,
Sunnyside Bussage Stroud.....Brimscombe 150
Walpamur Co. Ltd. The,Commercial rd..Gloucester 3411
Walters Rev. F. E,
Minsterworth vicarage Gloucester..Minsterworth 32
Walters J. T. & Co,Drprs,5 High st.....Ledbury 141
Walters & Son,Bkrs, Confctnrs,
Cotswold cafe.....Dursley 35
Waltham C,Btchr,5 Suffolk par.....Cheltenham 2151
Wallis G. Allan,
Waltham Watch Depot,14 King sq....Gloucester 3753
Walton E. L,The Northend Northgate st.Gloucester 356011
Walton J. Ltd,Fruit Mchts,
G.W.R. Goods yard.....Longhope 65
Walton Mrs. M,The Moorend Much Cowarne,
Bromyard.....Stirtn Grandison 14
Walton S. A,Frtr,19 Russell st.....Stroud 382
Walwin,Chmst,47 Southgate st.....Gloucester 2844
Walwin Mrs,Sunnymede Upton lane....Gloucester 6143
Wanklyn Mrs. W. L,
The Little Manor Charlton Kings...Cheltenham 3910
Wanswell Call Office,PO.....Sharpness 013
Warburton Mrs. E. M. T,
121 Cheltenham rd.....Cirencester 491

WAR DEPARTMENT—
Recruiting Office,353 High st.....Cheltenham 4193
Recruiting Office,The Barracks....Gloucester 2993
Ward A. D,Bank Agnt,etc,
Bank chambers High st.....Northleach 45
Ward Mrs. Addleton,Beechworth lawn..Cheltenham 2637
Ward Mrs. A. G,
Treelands 130 Leckhampton rd....Cheltenham 2273
Ward E. L. Ltd,Drprs, Frnshrs,High st★Cheltenham 5165
Ward E. L,2 Hatherley Court rd.....Cheltenham 4215
Ward E. T. & Son,Coal Mchts,G.W.R. wharf.Stroud 199
Ward Capt. F. C,
Hilfreda Barnwood rd.....Gloucester 3885
Ward Miss F. M,Southcote Kemerton.....Overbury 28
Ward Geo. W,Bldr,
Buckstone Oakland av.....Cheltenham 3543
Ward H. Walahman,Srgn,
Chipping manor.....Wotton-u-E 14
Ward J. E. L,Gambles End.....⊙Cleeve Hill 105
Ward & Woodman,Chmsts,Eastgate st..Gloucester 2825
Warden Mrs. Ellary,Swan cottage.....Much Marcle 15
Warden Capt. St. L. S,
Midland Bank Flat,1 Montpellier Ter.Cheltenham 3479
Warden Mrs. M. Fosse Wold.....Stow-on-the-Wold 102
Wardle-Smith J. H,
Winstone Cleve Cirencester.....Miserden 28
Ware E. P,Frmr,Sudgrove farm Stroud...Miserden 24
Ware Maj.-Gen. Sir Fabian,Dial cottage..Amberley 63
Ware G. S,Hide Market Northgate st....Gloucester 2531
Wares Private Hotel,Suffolk sq.....Cheltenham 2663
Wargent H,Parkhold cottage.....Trumpet 78
Wargent H. H,Garage Ashperton.....Trumpet 45
Wargent & Sons,Engrs,Canon Frome Stirtn Grandison 2
Warman Mrs. W,Woodlands.....Stroud 8
Warman W. & Son,Solrs,1 Rowcroft.....Stroud 17
Warn J,The Rivers.....Dursley 65
Warner A,Frmr,Highfield farm.....Tetbury 72y1
Warner A. E. F,Btchr,Frmr,Lawn Longfrd Gloucester 2694
Warner Bros,Motr Engrs,Twyning green....Bredon 23
Warner Maj. C. A. S,
Little Rissington manor....Bourton-on-the-W 49
Warner C. T,Garage,113 High st.....Tewkesbury 8
Warner E,The Cottage.....⊙Churchdown 253
Warner E,Haulier,Smow farm Ashcch..Tewkesbury 27
Warner E. R,Southwick.....Tewkesbury 206
Watkin W. R,Stroud rd.....Gloucester 3850
Watkins Mrs. A,Frogmore Little dean..Cinderford 2127
Watkins C. W,Faircaks Hollybush....Bromesberrow 42
Watkins E. L,Manor (farm Longdon....Birtsmorton 28
Watkins Fred (Iron Ore Mines),Coleford....Coleford 200
Watkins H. B,Commsn Agnt,
Mountaigne Woodside.....Bream 13
Watkins L. G,Baker,
The Bakery Ashperton Ledbury.....Trumpet 46
Watkins Maurice S,Bldr, Undtkr,
Wintles hill.....Westbury-on-S 36
Watkins R. J,Yarleton farm.....Longhope 66
Watkins T. J,Richfield.....Longhope 56
Watkins W. A,Haulage & Coal,
Frampton-on-Severn.....Saul 79
Watkins W. H,Grcr,7 High st.....Cheltenham 4161
Watney Lady Margaret,
Wilmstrp park Fairford Glos..Coln St. Aldwyns 40
Watson A. H,6 Cirencester rd.....Cheltenham 3155
Watson Rev. C. E,Churchfields ho Rodboro...Stroud 157
Watson Col. C. H,Del Ray ho.....Cheltenham 3734
Watson Mrs. Edgar, 5 Suffolk mans....Cheltenham 3869
Watson G. E,8 Gadshill rd Charlton Kings Cheltenham 3193
Watson Mrs. G. R,Wyeside.....St. Briavels 39
Watson M. T,Chmst,Rowcroft Pharmacy...Stroud 49
Watson R. E,Comm Agnt,
Commercial st.....Cinderford 3100
Watson R. S,High Elms Prestbury....Cheltenham 7154
Watson W. E,Fonthill Salperton....Guiting Power 70
Watson W. G,148 Old Bath rd.....Cheltenham 3340
Watson W. S. J,Pen Moel Park rd.....Stroud 519
Watson's,Soft Furnishings,3 Clarence st..Cheltenham 3898
Watt-Smyth Mrs,
Orchard cottage Woodmancote..⊙Cleeve Hill 41
Watts Mrs. B. A,Moor fm Moreton Valence....Saul 14
Watts Charles,Outfitter,148a High st...Cheltenham 4624
Watts Major E. M,
The Bungalow Middle Lyplatt.....Stroud 629
Watts (Factors) Ltd,Genl Fctrs,High st...★Lydney 92
Watts F. E,Frmr,Elm farm Elmore.....Hardwicke 13a4
Watts H. F,Electrcl Engr,Park rd.....Nailsworth 238
Watts John H,The Rocklands.....Lydney 134
Watts J. S. & Son,Irnmgrs,Bream.....Bream 15
Watts L. J,Bldr,Kings hill.....Dursley 164
Watts W. D,Rosemont.....Lydney 128
Watts W. & Son,Hairdrsrs,
Montpellier walk.....Cheltenham 3348
Waugh Evelyn,Piers ct Stinchcombe.....Dursley 250
Waylen C. W,Rosedene 356 Old Bath rd.Cheltenham 3451
Wayte W. J,Gayton Greenhills rd.....Cheltenham 3644
Wear L. R,34 Vicarage rd.....Gloucester 3762
Weare E. R,4 Oxford st.....Lydney 159
Wearne Rev. E. C,Barnsley, Cirencester.....Bibury 40
Weaver Mrs. A. M. M,
Spring cottage Llandogo.....St. Briavels 82
Weaver George & Sons,Fruit, Corn,
Castlemorton.....Bromesberrow 26
Weaver H,PO Berrow.....Bromesberrow 20
Weaver Mrs. J. Y,
The Plough Upper Oddington..Stow-on-the-W 134
Weaver Nurse,2 Berkeley vls Pittville..Cheltenham 2829
Weavers Stores,Grcrs,
Church st Charlton Kings.....Cheltenham 3446
Webb Mrs. A. E,21 Alexander rd.....Gloucester 3247
Webb Bros,Domestic Engrs,Belmont rd.....Stroud 290
Webb Bros. Ltd,Brick, Tile Mfrs,
Battledown works.....★Cheltenham 3001
Chal Mchts,14 Promenade.....★Cheltenham 3001
Colliery Agnts,Battledown works.★Cheltenham 3001
Webb B. S,Station gar Charlton Kings..Cheltenham 3747

	How do we search?	What do we get?
Phone book		

	How do we search?	What do we get?
Phone book	Person’s name	Address, phone number

Rolodex

How do we use a Rolodex?

	How do we search?	What do we get?
Phone book	Person’s name	Address, phone number
Rolodex		

	How do we search?	What do we get?
Phone book	Person’s name	Address, phone number
Rolodex	Company name	Address, phone number

Book index

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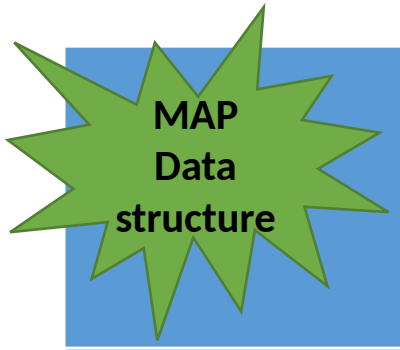
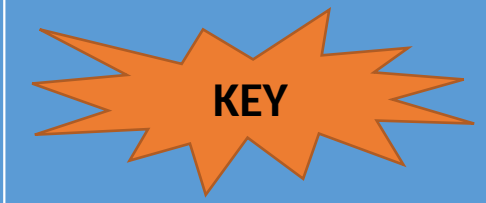
	How do we search?	What do we get?
Phone book	Person’s name	Address, phone number
Rolodex	Company name	Address, phone number
Book index		

	How do we search?	What do we get?
Phone book	Person’s name	Address, phone number
Rolodex	Company name	Address, phone number
Book index	Word	Page numbers



	How do we search? 	What do we get?
Phone book	Person's name	Address, phone number
Rolodex	Company name	Address, phone number
Book index	Word	Page numbers

	How do we search?	What do we get?

Phone book	Person's name
	
	`string`
		Address, phone number
		`class Address {`
		`  string line1, line2;`
		`  string city;`
		`  int zipcode;`
		`}`

Rolodex	Company name	Address, phone number
Book index	Word `string`	Page numbers `vector<int>`

Maps and Key-Value Entries

- A map models a searchable collection of ***key-value*** entries
  - An entry stores a key-value pair (k, v)
- The main operations of a map are for searching, inserting, and deleting items
- Multiple entries with the same key are not allowed
- Applications:
  - address book
  - student-record database

- Value can be any type/class
- Key can also be any type/class
  - BUT must be ***comparable***
  - *"Smith" < "Titan"*

std::map

- http://www.cplusplus.com/reference/map/map/

```
#include <map>
#include <string>

class Address {
public:
 std::string line1, line2;
 std::string city;
 int zipcode;
}

std::map<string, Address> myRolodex;
```

std::map insert using [ ]

```
map<string, Address> myRolodex;
```

- Adding to the rolodex

```
Address address = {"800 N State College Blvd", ""
                   "Fullerton";
                   92831};

string aName = “Tom Titan”;

myRolodex[aName] = address;
```

std::map search using [ ]

```
map<string, Address> myRolodex;
```

- Searching the rolodex

```
Address address;
string aName = “Tom Titan”;

address = myRolodex[aName];
cout << aName << “ is at “;
cout << address.line1 << address.line2
     << address.city
     << address.zipcode << '\n';
```

std::map find

```
map<string, Address> myRolodex;
```

- Searching the rolodex:
  - What if the key is NOT there?
  - std::map automatically inserts a value!
  - Must first check with find

find() returns an iterator
if the iterator == end iterator,
then the key was not found

```
string aName = "Tom Titan";

if (myRolodex.find(aName) == myRolodex.end()) {
     // aName is not in map
}
else {
  Address address;
  address = myRolodex[aName];
   cout << aName << " is at ";
   cout << address.line1 << address.line2
        << address.city
        << address.zipcode << '\n';
}
```

std::map find

```
map<string, Address> myRolodex;

string aName = "Tom Titan";
```

- Changing the rolodex:
  - What if the key is NOT there?
  - std::map automatically inserts a value!
  - Must first check with find

```
map<string, Address>::iterator it = myRolodex.find(aName);
if (it == myRolodex.end()) {
     // aName is not in map
}
else {
 Address address;
 …
 it->second = address;
}
```

std::map iteration

```
map<string, Address> myRolodex;
```

- Going through all entries in the rolodex:
  - Use iterators
  - Just like other data structures
  - But values will ALWAYS be in sorted order

```
string aName = "Tom Titan";

map<string, Address>::iterator it;
for (it = myRolodex.begin(); i                nd(); it++) {
  cout << it->first << " is at ";
  cout << it->second.line1 << it->second.line2
       << it->second.city << it->second.zipcode << '\n';
}
```

it->first returns the key
it->second returns the value

std::map erase

```
map<string, Address> myRolodex;

string aName = “Tom Titan”;
map<string, Address>::iterator it =
myRolodex.find(aName);
if (it == myRolodex.end()) {
    // aName is not in map
}
else {
 myRolodex.erase(it);
}
```