

```
1: // $Id: listmap.h,v 1.29 2021-05-22 02:29:26-07 - - $
2: //Kai O'Brien (kimobrie@ucsc.edu)
3:
4: #ifndef __LISTMAP_H__
5: #define __LISTMAP_H__
6:
7: #include "debug.h"
8: #include "xless.h"
9: #include "xpair.h"
10:
11: #define SHOW_LINK(FLAG,PTR) { \
12:     DEBUGB (FLAG, #PTR << "=" << PTR \
13:         << ": next=" << PTR->next \
14:         << ", prev=" << PTR->prev); \
15: }
16:
17: template <typename key_t, typename mapped_t, class less_t=xless<key_t>>
18: class listmap {
19:     public:
20:         using key_type = key_t;
21:         using mapped_type = mapped_t;
22:         using value_type = xpair<const key_type, mapped_type>;
23:     private:
24:         less_t less;
25:         struct node;
26:         struct link {
27:             node* next{};
28:             node* prev{};
29:             link (node* next_, node* prev_): next(next_), prev(prev_){}
30:         };
31:         struct node: link {
32:             value_type value{};
33:             node (node* next_, node* prev_, const value_type& value_):
34:                 link (next_, prev_), value(value_){}
35:         };
36:         node* anchor() { return static_cast<node*> (&anchor_); }
37:         link anchor_ {anchor(), anchor()};
38:     public:
39:         class iterator;
40:         listmap(){};
41:         listmap (const listmap&);
42:         listmap& operator= (const listmap&);
43:         ~listmap();
44:         iterator insert (const value_type&);
45:         iterator find (const key_type&);
46:         iterator erase (iterator position);
47:         iterator begin() { return anchor()->next; }
48:         iterator end() { return anchor(); }
49:         bool empty() const { return anchor_.next == &anchor_; }
50:         operator bool() const { return not empty(); }
51: };
52:
```

```
53:
54: template <typename key_t, typename mapped_t, class less_t>
55: class listmap<key_t,mapped_t,less_t>::iterator {
56:     friend class listmap<key_t,mapped_t,less_t>;
57:     private:
58:         listmap<key_t,mapped_t,less_t>::node* where {nullptr};
59:         iterator (node* where_): where(where_){};
60:     public:
61:         iterator() {}
62:         value_type& operator*() {
63:             SHOW_LINK ('b', where);
64:             return where->value;
65:         }
66:         value_type* operator->() { return &(where->value); }
67:         iterator& operator++() { where = where->next; return *this; }
68:         iterator& operator--() { where = where->prev; return *this; }
69:         bool operator== (const iterator& that) const {
70:             return this->where == that.where;
71:         }
72:         bool operator!= (const iterator& that) const {
73:             return this->where != that.where;
74:         }
75:         operator bool() const { return where != nullptr; }
76: };
77:
78: #include "listmap.tcc"
79: #endif
80:
```

```
1: // $Id: listmap.tcc,v 1.22 2021-05-22 21:33:03-07 - - $
2: //Kai O'Brien (kimobrie@ucsc.edu)
3:
4: #include "listmap.h"
5: #include "debug.h"
6:
7: //
8: ///////////////////////////////////////////////////////////////////
9: // Operations on listmap.
10: ///////////////////////////////////////////////////////////////////
11: //
12: //do ~ insert find and erase + main
13:
14: //
15: // listmap::~listmap()
16: //
17: template <typename key_t, typename mapped_t, class less_t>
18: listmap<key_t,mapped_t,less_t>::~listmap() {
19:     DEBUGF ('l', reinterpret_cast<const void*> (this));
20:     //typical double linked list destructor
21:     //begin() is the "head"
22:     //DONT DELETE ANCHOR!
23:     node* temp1 = begin().where;//or just do anchor().next
24:     node* temp2;
25:     while(temp1!=anchor()){
26:         temp2 = temp1;
27:         temp1 = temp1->next;
28:         delete temp2;
29:         // erase(temp2);
30:     }
31: }
32:
33: //
34: // iterator listmap::insert (const value_type&)
35: //
36: template <typename key_t, typename mapped_t, class less_t>
37: typename listmap<key_t,mapped_t,less_t>::iterator
38: listmap<key_t,mapped_t,less_t>::insert (const value_type& pair) {
39:     DEBUGF ('l', &pair << "->" << pair);
40:     //if empty
41:     if(empty()){
42:         node *empty_node = new node(anchor(),anchor(),pair);
43:         anchor_.next = empty_node;
44:         anchor_.prev = empty_node;
45:         return iterator(empty_node);
46:     }
47:     //otherwise
48:     //if key is already there, the value is replaced
49:     node *new_node = new node(nullptr,nullptr,pair);
50:     for (auto itor = begin(); itor != end(); ++itor) {
51:         //if the itr is == key, update value
52:         if(!less(itor->first,pair.first) &&
53:            !less(pair.first,itor->first)) {
54:             itor->second = pair.second;//?? maybe
55:             return itor;
56:         }
57:         //if pair.first is >= itor, not less than itor
58:         else if(!less(pair.first,itor->first)){
```

```
59:         //at the end of the list, pair.first is greater
60:         // than the end, what to do
61:         new_node->next = itor.where->next;
62:         new_node->prev = itor.where;
63:         if(itor.where->next!=nullptr){
64:             itor.where->next->prev = new_node;
65:         }
66:         itor.where->next = new_node;
67:         break;
68:     }
69: }
70:
71: return iterator(new_node);
72:
73: }
74:
75: //
76: // listmap::find(const key_type&)
77: // cant use ==, must use less()
78: //if not is less and not is greater
79: template <typename key_t, typename mapped_t, class less_t>
80: typename listmap<key_t,mapped_t,less_t>::iterator
81: listmap<key_t,mapped_t,less_t>::find (const key_type& that) {
82:     DEBUGF ('l', that);
83:     auto itor = begin();
84:     //for (auto itor = begin(); itor != end(); ++itor) {
85:     while(itor !=end()){
86:         if(!less(itor->first,that) && !less(that,itor->first)){
87:             //return itor;
88:             //return iterator(itor);
89:             break;
90:         }
91:         ++itor;
92:     }
93:     //return end();
94:     return iterator(itor);
95: }
96:
97: //
98: // iterator listmap::erase (iterator position)
99: //
100: template <typename key_t, typename mapped_t, class less_t>
101: typename listmap<key_t,mapped_t,less_t>::iterator
102: listmap<key_t,mapped_t,less_t>::erase (iterator position) {
103:     DEBUGF ('l', &*position);
104:     //dont need to iterate because have .where
105:
106:     node *temp = position.where;
107:     iterator p = temp->prev;
108:     iterator n = temp->next;
109:     p->where->next = n->where;
110:     n->where->prev = p->where;
111:
112:     //delete temp->key;
113:     delete temp;//valgrind
114:     return n;//should return temp->next's position
115:
116: }
```

05/22/21  
21:33:03

~/cse111/assignment3/code  
listmap.tcc

3

117:  
118:

```
1: // $Id: xless.h,v 1.3 2014-04-24 18:02:55-07 - - $
2:
3: #ifndef __XLESS_H__
4: #define __XLESS_H__
5:
6: //
7: // We assume that the type type_t has an operator< function.
8: //
9:
10: template <typename Type>
11: struct xless {
12:     bool operator() (const Type& left, const Type& right) const {
13:         return left < right;
14:     }
15: };
16:
17: #endif
18:
```

```
1: // $Id: xpair.h,v 1.5 2019-02-21 17:27:16-08 - - $
2:
3: #ifndef __XPAIR_H__
4: #define __XPAIR_H__
5:
6: #include <iostream>
7:
8: using namespace std;
9:
10: //
11: // Class xpair works like pair(c++).
12: //
13: // The implicitly generated members will work, because they just
14: // send messages to the first and second fields, respectively.
15: // Caution: xpair() does not initialize its fields unless
16: // first_t and second_t do so with their default ctors.
17: //
18:
19: template <typename first_t, typename second_t>
20: struct xpair {
21:     first_t first{};
22:     second_t second{};
23:     xpair() {}
24:     xpair (const first_t& first_, const second_t& second_):
25:         first(first_), second(second_) {}
26: };
27:
28: template <typename first_t, typename second_t>
29: ostream& operator<< (ostream& out,
30:                     const xpair<first_t,second_t>& pair) {
31:     out << "{" << pair.first << "," << pair.second << "}";
32:     return out;
33: }
34:
35: #endif
36:
```

```
1: // $Id: debug.h,v 1.6 2021-05-22 02:29:26-07 - - $
2: //Kai O'Brien (kimobrie@ucsc.edu)
3:
4: #ifndef __DEBUG_H__
5: #define __DEBUG_H__
6:
7: #include <bitset>
8: #include <climits>
9: #include <string>
10: using namespace std;
11:
12: // debug -
13: //      static class for maintaining global debug flags.
14: // setflags -
15: //      Takes a string argument, and sets a flag for each char in the
16: //      string. As a special case, '@', sets all flags.
17: // getflag -
18: //      Used by the DEBUGF macro to check to see if a flag has been set.
19: //      Not to be called by user code.
20:
21: class debugflags {
22:     private:
23:         using flagset = bitset<UCHAR_MAX + 1>;
24:         static flagset flags;
25:     public:
26:         static void setflags (const string& optflags);
27:         static bool getflag (char flag);
28:         static void where (char flag, const char* file, int line,
29:                           const char* pretty_function);
30: };
31:
```



```
32:
33: // DEBUGF -
34: //     Macro which expands into debug code.  First argument is a
35: //     debug flag char, second argument is output code that can
36: //     be sandwiched between <<.  Beware of operator precedence.
37: //     Example:
38: //         DEBUGF ('u', "foo = " << foo);
39: //     will print two words and a newline if flag 'u' is on.
40: //     Traces are preceded by filename, line number, and function.
41:
42: #ifdef NDEBUG
43: #define DEBUGB(FLAG, CODE) ;
44: #define DEBUGF(FLAG, CODE) ;
45: #define DEBUGS(FLAG, STMT) ;
46: #else
47: #define DEBUGB(FLAG, CODE) { \
48:     if (debugflags::getflag (FLAG)) { \
49:         debugflags::where (FLAG, __FILE__, __LINE__, \
50:             __PRETTY_FUNCTION__); \
51:         cerr << CODE << endl; \
52:     } \
53: }
54: #define DEBUGF(FLAG, CODE) { \
55:     if (debugflags::getflag (FLAG)) { \
56:         debugflags::where (FLAG, __FILE__, __LINE__, \
57:             __PRETTY_FUNCTION__); \
58:         cerr << CODE << endl; \
59:     } \
60: }
61: #define DEBUGS(FLAG, STMT) { \
62:     if (debugflags::getflag (FLAG)) { \
63:         debugflags::where (FLAG, __FILE__, __LINE__, \
64:             __PRETTY_FUNCTION__); \
65:         STMT; \
66:     } \
67: }
68: #endif
69:
70: #endif
71:
```

```
1: // $Id: debug.cpp,v 1.4 2021-05-22 02:29:26-07 - - $
2: //Kai O'Brien (kimobrie@ucsc.edu)
3:
4: #include <climits>
5: #include <iostream>
6: using namespace std;
7:
8: #include "debug.h"
9: #include "util.h"
10:
11: debugflags::flagset debugflags::flags {};
12:
13: void debugflags::setflags (const string& initflags) {
14:     for (const unsigned char flag: initflags) {
15:         if (flag == '@') flags.set();
16:         else flags.set (flag, true);
17:     }
18: }
19:
20: // getflag -
21: //     Check to see if a certain flag is on.
22:
23: bool debugflags::getflag (char flag) {
24:     // WARNING: Don't TRACE this function or the stack will blow up.
25:     return flags.test (static_cast<unsigned char> (flag));
26: }
27:
28: void debugflags::where (char flag, const char* file, int line,
29:                        const char* pretty_function) {
30:     cout << sys_info::execname() << ": DEBUG(" << flag << ") "
31:          << file << "[" << line << "]" " << endl
32:          << "    " << pretty_function << endl;
33: }
34:
```

```
1: // $Id: util.h,v 1.9 2021-04-28 12:12:32-07 - - $
2:
3: //
4: // util -
5: //     A utility class to provide various services not conveniently
6: //     associated with other modules.
7: //
8:
9: #ifndef __UTIL_H__
10: #define __UTIL_H__
11:
12: #include <iostream>
13: #include <stdexcept>
14: #include <string>
15: using namespace std;
16:
17: //
18: // sys_info -
19: //     Keep track of execname and exit status.  Must be initialized
20: //     as the first thing done inside main.  Main should call:
21: //         sys_info::set_execname (argv[0]);
22: //     before anything else.
23: //
24:
25: class sys_info {
26:     private:
27:         static string execname_;
28:         static int exit_status_;
29:         static void execname (const string& argv0);
30:         friend int main (int, char**);
31:     public:
32:         static const string& execname ();
33:         static void exit_status (int status);
34:         static int exit_status ();
35: };
36:
```

```
37:
38: //
39: // complain -
40: //     Used for starting error messages.  Sets the exit status to
41: //     EXIT_FAILURE, writes the program name to cerr, and then
42: //     returns the cerr ostream.  Example:
43: //         complain() << filename << ": some problem" << endl;
44: //
45:
46: ostream& complain();
47:
48: //
49: // syscall_error -
50: //     Complain about a failed system call.  Argument is the name
51: //     of the object causing trouble.  The extern errno must contain
52: //     the reason for the problem.
53: //
54:
55: void syscall_error (const string&);
56:
57: //
58: // string to_string (thing) -
59: //     Convert anything into a string if it has an ostream<< operator.
60: //
61:
62: template <typename item_t>
63: string to_string (const item_t&);
64:
65: //
66: // thing from_string (const string&) -
67: //     Scan a string for something if it has an istream>> operator.
68: //
69:
70: template <typename item_t>
71: item_t from_string (const string&);
72:
73: //
74: // Put the RCS Id string in the object file.
75: //
76:
77: #include "util.tcc"
78: #endif
79:
```

```
1: // $Id: util.tcc,v 1.4 2020-02-06 12:33:29-08 - - $
2:
3: #include <sstream>
4: #include <typeinfo>
5: using namespace std;
6:
7: template <typename Type>
8: string to_string (const Type& that) {
9:     ostringstream stream;
10:    stream << that;
11:    return stream.str();
12: }
13:
14: template <typename Type>
15: Type from_string (const string& that) {
16:    stringstream stream;
17:    stream << that;
18:    Type result;
19:    if (not (stream >> result and stream.eof())) {
20:        throw domain_error (string (typeid (Type).name())
21:                                + " from_string (" + that + ")");
22:    }
23:    return result;
24: }
25:
```

```
1: // $Id: util.cpp,v 1.18 2020-02-06 12:55:59-08 - - $
2:
3: #include <cassert>
4: #include <cerrno>
5: #include <cstdlib>
6: #include <cstring>
7: #include <ctime>
8: #include <stdexcept>
9: #include <string>
10: using namespace std;
11:
12: #include "debug.h"
13: #include "util.h"
14:
15: int sys_info::exit_status_ = EXIT_SUCCESS;
16: string sys_info::execname_; // Must be initialized from main().
17:
18: void sys_info::execname (const string& argv0) {
19:     assert (execname_ == "");
20:     int slashpos = argv0.find_last_of ('/') + 1;
21:     execname_ = argv0.substr (slashpos);
22:     cout << boolalpha;
23:     cerr << boolalpha;
24:     DEBUGF ('u', "execname_ = " << execname_);
25: }
26:
27: const string& sys_info::execname () {
28:     assert (execname_ != "");
29:     return execname_;
30: }
31:
32: void sys_info::exit_status (int status) {
33:     assert (execname_ != "");
34:     exit_status_ = status;
35: }
36:
37: int sys_info::exit_status () {
38:     assert (execname_ != "");
39:     return exit_status_;
40: }
41:
42: ostream& complain() {
43:     sys_info::exit_status (EXIT_FAILURE);
44:     cerr << sys_info::execname () << ": ";
45:     return cerr;
46: }
47:
48: void syscall_error (const string& object) {
49:     complain() << object << ": " << strerror (errno) << endl;
50: }
51:
```

```
1: // $Id: main.cpp,v 1.20 2021-05-22 21:33:03-07 - - $
2: //Kai O'Brien (kimobrie@ucsc.edu)
3:
4: #include <cstdlib>
5: #include <exception>
6: #include <iostream>
7: #include <string>
8: #include <unistd.h>
9: //-----
10: #include <cassert>
11: #include <cerrno>
12: #include <fstream>
13: #include <iomanip>
14: #include <regex>
15: #include <stdexcept>
16: #include <typeinfo>
17:
18: using namespace std;
19:
20: #include "listmap.h"
21: #include "xpair.h"
22: #include "util.h"
23:
24: //m.insert(xpair{key,value})
25:
26: using str_str_map = listmap<string,string>;
27: using str_str_pair = str_str_map::value_type;
28: str_str_map test;//listmap
29:
30: void scan_options (int argc, char** argv) {
31:     opterr = 0;
32:     for (;;) {
33:         int option = getopt (argc, argv, "@:");
34:         if (option == EOF) break;
35:         switch (option) {
36:             case '@':
37:                 debugflags::setflags (optarg);
38:                 break;
39:             default:
40:                 complain() << "-" << char (optopt) << ": invalid option"
41:                     << endl;
42:                 break;
43:         }
44:     }
45: }
46:
47: void whitespace(string *line){
48:     //trim leading whitespace and returns position of =sign or -1
49:     unsigned long first = 0;//0 or 1?
50:     while(first<line->size() &&line->at(first) == ' '){
51:         line->erase(first,1);//at first position
52:         if(line->at(first)=='='){
53:
54:         }
55:         ++first;
56:     }
57:     int mid = 1;
58:     while(first<line->size()){
```

```
59:         if(line->at(first)=='='){
60:         }
61:         if(line->at(first)=='\n'){
62:             line->erase(first,mid);//at first position
63:         }
64:         else{
65:             ++mid;
66:         }
67:         ++first;
68:     }
69:     //trims trailing whitespace
70:     ssize_t last = line->size()-1;//0 or 1?
71:     while(last>0 && line->at(last) == ' '){
72:         if(line->at(last)=='='){
73:         }
74:     }
75:     line->erase(last,line->size()-1);//at first position
76:     --last;
77: }
78: }
79:
80: size_t eq_pos(string *line){
81:     size_t eq = 1234;
82:     size_t first = 0;
83:     while(first<line->size()){
84:         if(line->at(first) == '='){
85:             eq = first;
86:             break;
87:         }
88:         ++first;
89:     }
90:
91:     return eq;
92: }
93:
94: //insert stuff to map when key = value not found
95: //just do insert because already wrote code for that
96: void catfile_helper (istream& infile, const string& filename) {
97:     static string colons (32, ':');
98:     cout << colons << endl << filename << endl << colons << endl;
99:     regex comment_regex {R"(\s*(#.*)?$)"};
100:    regex key_value_regex {R"(\s*(.?)\s*=\s*(.?)\s*$)"};
101:    regex trimmed_regex {R"(\s*([^\s=]+?)\s*$)"};
102:    int i = 1;
103:    for(;;) {
104:        string line;
105:        getline (infile, line);
106:        whitespace(&line);//trim whitespace
107:        //-----regex code
108:        //      cout << "input: \"" << line << "\"" << endl;
109:        if(line.length()>0){
110:            smatch result;
111:            if (regex_search (line, result, comment_regex)) {//prints twice
maybe idk
112:                cout<<filename<<": " <<i<<": " <<line<<endl;
113:
114:            }
115:
```



```
116:         else if (regex_search (line, result, key_value_regex)) {
117:             cout<<filename<<": " <<i<<": " <<line<<endl;
118:
119:             //=
120:             if(line.at(0)=='='){
121:                 //if the = is the only thing
122:                 if(line.size()==1){
123:                     for (auto itor = test.begin(); itor != test.end(); ++i
tor) {
124:                         cout<< itor->first<< " = " <<itor->second<<endl;
125:                     }
126:                 }
127:                 else{ //=value
128:                     for (auto itor = test.begin(); itor != test.end(); ++itor
) {
129:                         if(itor->second == result[2]){
130:                             cout<< itor->first<< " = " <<itor->second<<endl;
131:                         }
132:                     }
133:                 }
134:             }
135:
136:             else if(line.at(line.size()-1)=='='){ //key =
137:                 if(test.find(result[1])!=test.end() ){
138:                     test.erase(test.find(result[1])); //valgrind
139:                 }
140:                 else{
141:                     cout<< result[1]<< ": " <<"key not found"<<endl;
142:                 }
143:             }
144:             else{//key = value
145:                 cout<< result[1]<< " = " <<result[2]<<endl;
146:                 // cout << "key : \" << result[1] << "\"" << endl;
147:                 // cout << "value: \" << result[2] << "\"" << endl;
148:                 test.insert(str_str_pair(result[1],result[2]));
149:             }
150:         }
151:         // key = , =, or =value
152:         else if (regex_search (line, result, trimmed_regex)) {
153:             cout<<filename<<": " <<i<<": " <<line<<endl;
154:             cout<< result[1]<< endl;
155:             //if its the key(can be more than 1 word key
156:             //) and nothing else, print the value
157:             size_t eq_pos1 = eq_pos(&line);
158:             //if no eq sign
159:             //key
160:             if(eq_pos1==1234){
161:                 auto it = test.find(result[1]);
162:                 if(test.find(result[1])!=test.end()){
163:                     cout<< it->first<< " = " <<it->second<<endl;
164:                 }
165:                 else{
166:                     cout<< result[1]<< ": " <<"key not found"<<endl;
167:                 }
168:             }
169:         }
170:
171:
```

```
172:         //cout << "query: \"" << result[1] << "\"" << endl;
173:     }else {
174:         assert (false and "This can not happen.");
175:     }
176:     //-----
177:
178:     // cout << line << endl;
179:     i++;
180: }
181: if (infile.eof()) break;
182: }
183: }
184: // node* temp = new node(anchor(), anchor(), pair);
185:
186: int main (int argc, char** argv) {
187:     sys_info::execname (argv[0]);
188:     scan_options (argc, argv);
189:     //-----matchlines
190:     const string cin_name = "-";
191:     int status = 0;
192:     string progname ( (argv[0]));
193:     vector<string> filenames (&argv[1], &argv[argc]);
194:     if (filenames.size() == 0) filenames.push_back (cin_name);
195:     for (const auto& filename: filenames) {
196:         if (filename == cin_name) catfile_helper (cin, filename);
197:         else {
198:             ifstream infile (filename);
199:             if (infile.fail()) {
200:                 status = 1;
201:                 cerr << progname << ": " << filename << ": "
202:                     << strerror (errno) << endl;
203:             }else {
204:                 catfile_helper (infile, filename);
205:                 infile.close();
206:             }
207:         }
208:     }
209:     return status;
210:     // cout << "EXIT_SUCCESS" << endl;
211:     // return EXIT_SUCCESS;
212: }
213:
```

```
1: # $Id: Makefile,v 1.27 2021-05-22 02:29:26-07 - - $
2: #Kai O'Brien (kimobrie@ucsc.edu)
3:
4: MKFILE      = Makefile
5: DEFILE      = ${MKFILE}.dep
6: NOINCL      = ci clean spotless check lint
7: NEEDINCL    = ${filter ${NOINCL}, ${MAKECMDGOALS}}
8: GMAKE       = ${MAKE} --no-print-directory
9:
10: GPPWARN      = -Wall -Wextra -Wpedantic -Wshadow -Wold-style-cast
11: GPPOPTS      = ${GPPWARN} -fdiagnostics-color=never
12: COMPILECPP   = g++ -std=gnu++17 -g -O0 ${GPPOPTS}
13: MAKEDEPCPP   = g++ -std=gnu++17 -MM ${GPPOPTS}
14: UTILBIN      = /afs/cats.ucsc.edu/courses/cse111-wm/bin
15:
16: MODULES      = listmap xless xpair debug util main
17: CPPSOURCE    = ${wildcard ${MODULES:=.cpp}}
18: OBJECTS      = ${CPPSOURCE:.cpp=.o}
19: SOURCELIST    = ${foreach MOD, ${MODULES}, ${MOD}.h ${MOD}.tcc ${MOD}.cpp}
20: ALLSOURCE    = ${wildcard ${SOURCELIST}}
21: EXECBIN      = keyvalue
22: OTHERS       = ${MKFILE} ${DEFILE}
23: ALLSOURCES    = ${ALLSOURCE} ${OTHERS}
24: LISTING      = Listing.ps
25:
26: all : ${EXECBIN}
27:
28: ${EXECBIN} : ${OBJECTS}
29:             ${COMPILECPP} -o $@ ${OBJECTS}
30:
31: %.o : %.cpp
32:             ${COMPILECPP} -c $<
33:
34: lint : ${CPPSOURCE}
35:             ${UTILBIN}/cpplint.py.perl ${CPPSOURCE}
36:
37: check : ${ALLSOURCES}
38:             ${UTILBIN}/checksource ${ALLSOURCES}
39:
40: ci : ${ALLSOURCES}
41:             ${UTILBIN}/cid -is ${ALLSOURCES}
42:
43: lis : ${ALLSOURCES}
44:             mkpspdf ${LISTING} ${ALLSOURCES}
45:
46: clean :
47:         - rm ${OBJECTS} ${DEFILE} core
48:
49: spotless : clean
50:         - rm ${EXECBIN} ${LISTING} ${LISTING:.ps=.pdf}
51:
52: dep : ${ALLCPPSRC}
53:         @ echo "# ${DEFILE} created `LC_TIME=C date`" >${DEFILE}
54:         ${MAKEDEPCPP} ${CPPSOURCE} >>${DEFILE}
55:
56: ${DEFILE} :
57:         @ touch ${DEFILE}
58:         ${GMAKE} dep
```

```
59:
60: again :
61:     ${GMAKE} spotless dep ci all lis
62: submit:
63:     submit cse111-wm.s21 ko3 *.cpp *.tcc *.h Makefile README
64:
65: ifeq (${NEEDINCL}, )
66: include ${DEPFILE}
67: endif
68:
```

```
1: # Makefile.dep created Sat May 22 21:33:03 PDT 2021
2: debug.o: debug.cpp debug.h util.h util.tcc
3: util.o: util.cpp debug.h util.h util.tcc
4: main.o: main.cpp listmap.h debug.h xless.h xpair.h listmap.tcc util.h \
5:  util.tcc
```