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2 WINDOWS CPLEX COMPIRATION – INFO & INSTRUCTIONS

To execute the code, we need in order:

- Visual Studio IDE (note: this is different from Visual Studio Code)
 - o Installing the Community Version from [here](#)
- A C++ compiler
 - o You can either use MinGW ([here](#)) or MSVC (done when selecting “Develop C++ applications” when installing Visual Studio)
- CPLEX Studio installed on your machine (current version is 22.11)
 - o All of the info present in the Moodle of the course [here](#)

The problem on Windows is evidenced by the fact that fatal errors might occur, like:

```
lex/ilcplex.h: No such file or directory
#include <ilcplex/ilcplex.h>
^~~~~~
compilation terminated.

Build finished with error(s).
The terminal process failed to launch (exit code: -1).

Terminal will be reused by tasks, press any key to close it.
```

As seen [here](#), a normal execution of Cplex would include:

```
C:\Program Files\IBM\ILOG\CPLEX_Studio_Community201\cplex\include
C:\Program Files\IBM\ILOG\CPLEX_Studio_Community201\concert\include
```

These folder need to be configured inside of the additional inclusions and also additional dependencies in the form of files and directives to the compiler.

The most recent versions (up to 2019, current is 2022) do not allow complete editing of the compilation options as you might see [here](#).

As found within the internal group of the course, the main problem seems to be that there is not `cpxmacro.h` file inside of Windows installations, so if we try to use it in our project we have problem with functions for declaration of env, adding variables and constraints.

3 WINDOWS CPLEX COMPILED – SOLUTION 1

The solution is actually the following:

- Once you have installed Visual Studio and CPLEX on your machine, you should take some ready-made examples, so to import a Solution file (basically, a configuration file which needs to be imported in order to make the execution work) and then an executable file with a main()

The paths to consider for solution files are the following:

- C++ files:

C:\Program
Files\IBM\ILOG\CPLEX_Studio2211\cplex\examples\x64_windows_msvc14\stat_mda

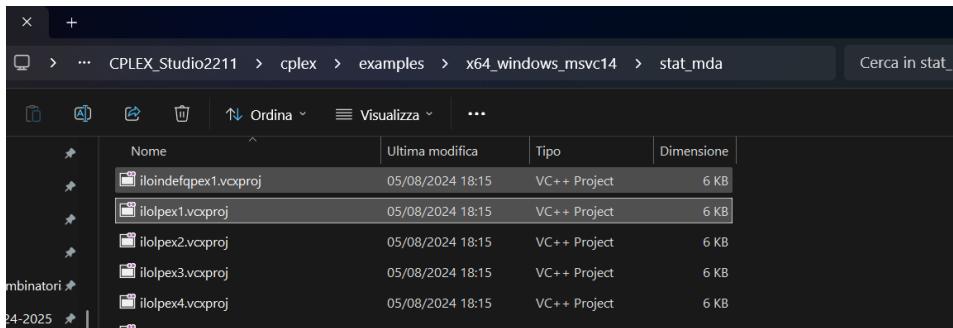
- C files:

C:\Program
Files\IBM\ILOG\CPLEX_Studio2211\cplex\examples\x64_windows_msvc14\stat_mdd

These folders report a lot of different files which are the “Solution” files; we need to consider files with extension .vcxproj. The goal here would be to first select a Solution file and then select a C/C++ file of the same name. So:

- If you want to execute a C example, go the “mdd”
- If you want to execute a C++ example, go to “mdd”

For instance, let's consider ilolpex1.vcxproj, which is a C++ file:



We then need the actual source codes, which are to be linked with the respective vcxproj files of before. Once again, it's different for both formats:

- C files:

C:\Program Files\IBM\ILOG\CPLEX_Studio2211\cplex\examples\src\c

- C++ files:

C:\Program Files\IBM\ILOG\CPLEX_Studio2211\cplex\examples\src\cpp

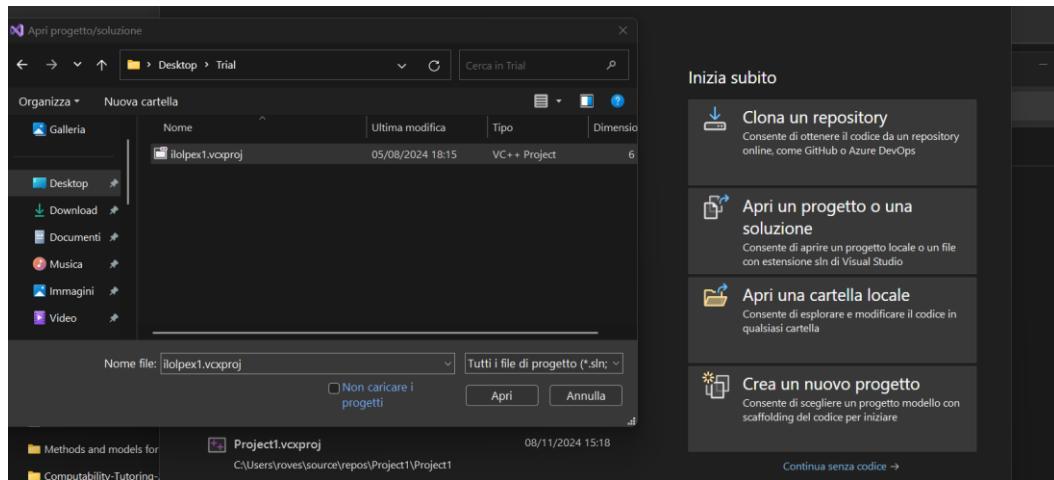
We then take the file of the same name as before:

Nome	Ultima modifica	Tipo	Dimensione
ilogalex3.cpp	05/08/2024 18:15	File di origine C++	5 KB
iloindefpex1.cpp	05/08/2024 18:15	File di origine C++	4 KB
ilolpex1.cpp	05/08/2024 18:15	File di origine C++	6 KB
ilolpex2.cpp	05/08/2024 18:15	File di origine C++	5 KB
ilolpex3.cpp	05/08/2024 18:15	File di origine C++	4 KB

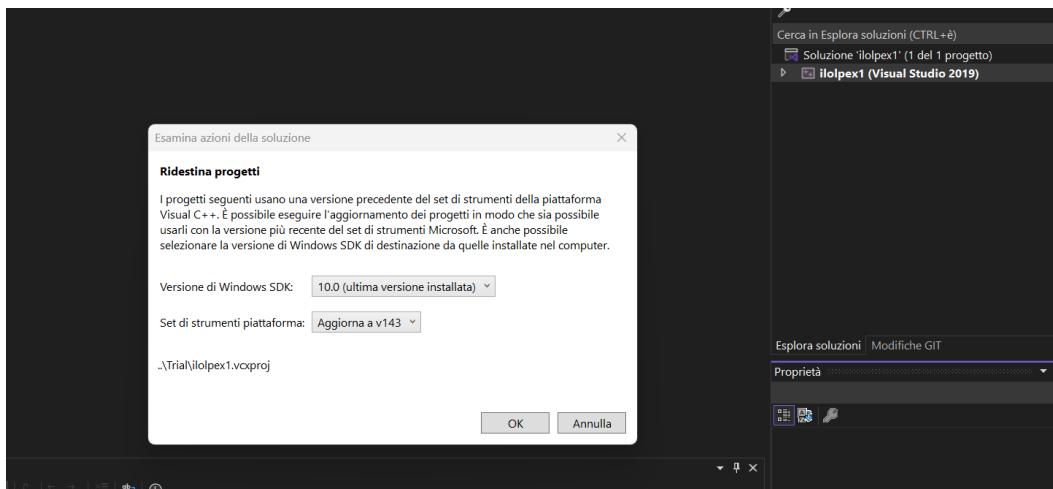
We need both files in order to import them into Visual Studio and then customize the code of the actual source file (C/C++) so to make the code work fine. We then create a folder with a custom name on a custom location with both files, like the following:

Nome	Ultima modifica	Tipo	Dimensione
ilolpex1.cpp	05/08/2024 18:15	File di origine C++	6 KB
ilolpex1.vcxproj	05/08/2024 18:15	VC++ Project	6 KB

We then open Visual Studio loading the vcxproj file on “Open a project or a solution” file.

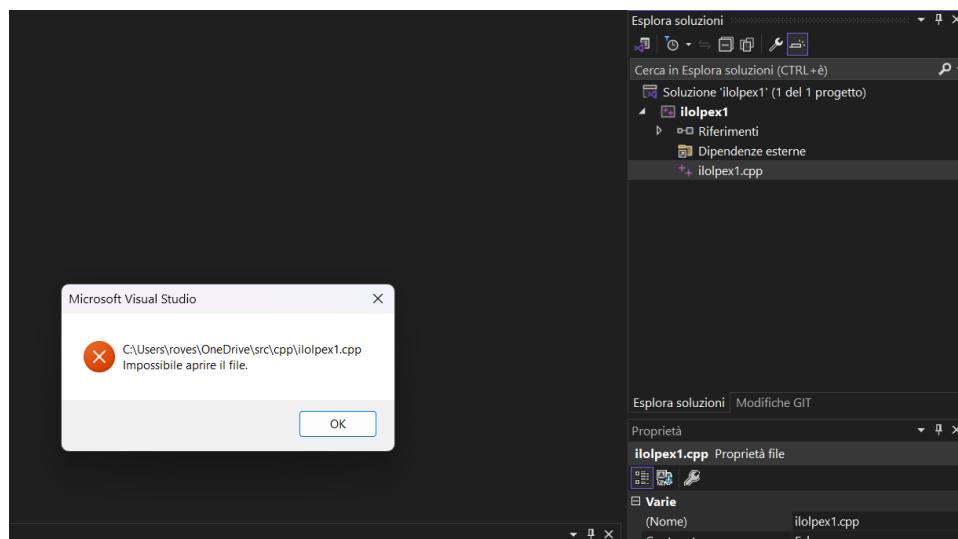


Once the prompt is open, select the Windows SDK version and multiplatform by default and continue.

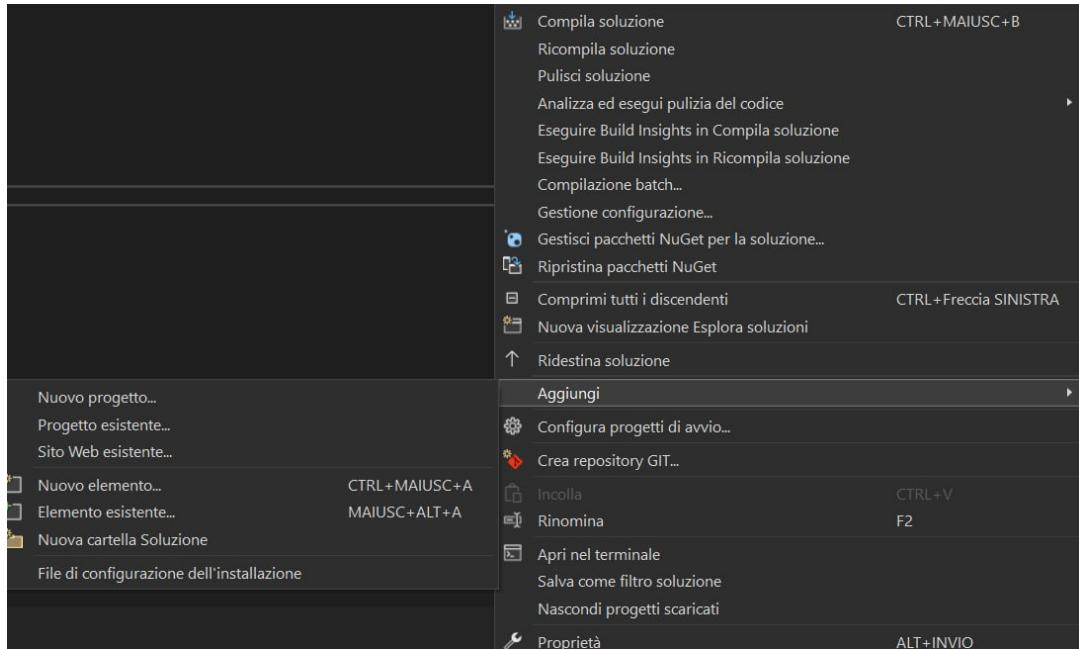


WARNING

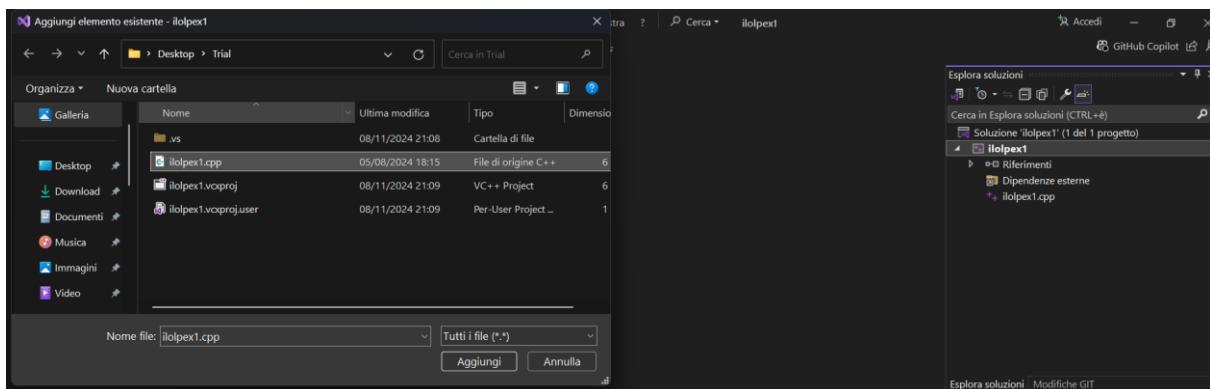
At this point, since the vcxproj file points to files present in the previous path (so inside of the Cplex path), it will tell you “Impossible to open file”, since it does not see the local path:



What you will do to solve this problem, is to right-click the name of project in the right menu present (in this case where there is `ilolpex1`) and then click “Add” (Aggiungi) and then click on “Existing element” (Elemento esistente):



Here we will select the actual C/C++ file:



Please remove the old file which is not to be found, so you have only one, the correctly imported file. You should see something like this:

```

1 // File: ilolpex1.cpp
2 // Version 22.1.1
3 //
4 //
5 // Licensed Materials - Property of IBM
6 // 5T25-A06 5T25-A29 5T24-Y08 5T24-Y09 5T24-Y54 5T24-Y55 5S65-Y21
7 // Copyright IBM Corporation 2000, 2022. All Rights Reserved.
8 //
9 // US Government Users Restricted Rights - Use, duplication or
10 // disclosure restricted by GSA ADP Schedule Contract with
11 // IBM Corp.
12 //
13 //
14 // ilolpex1.cpp - Entering and optimizing a problem. Demonstrates different
15 // methods for creating a problem. The user has to choose the method
16 // on the command line:
17 //
18 //   ilolpex1 -r      generates the problem by adding rows
19 //   ilolpex1 -c      generates the problem by adding columns
20 //   ilolpex1 -n      generates the problem by adding a list of coefficients
21 //
22 #include <ilcplex/iocplex.h>
23 #include "ilolpex1.h"
24 //
25 static void
26 usage (const char *programname,
27        const char *modelname,
28        const char *varname,
29        const char *conname);
30
31 int main (int argc, const char *argv[])
32 {
33     if (argc < 2)
34         usage (programname, modelname, varname, conname);
35     else
36         solveproblem (modelname, varname, conname);
37 }
38
39 void
40 solveproblem (const char *modelname,
41               const char *varname,
42               const char *conname)
43 {
44     IloCplex cplex;
45     IloModel model;
46     IloNumVarArray var;
47     IloRangeArray con;
48
49     ...
50 }
51
52 void
53 usage (const char *programname,
54        const char *modelname,
55        const char *varname,
56        const char *conname)
57 {
58     ...
59 }
60
61 void
62 solveproblem (const char *modelname,
63               const char *varname,
64               const char *conname)
65 {
66     ...
67 }
68
69 void
70 usage (const char *programname,
71        const char *modelname,
72        const char *varname,
73        const char *conname)
74 {
75     ...
76 }
77
78 void
79 solveproblem (const char *modelname,
80               const char *varname,
81               const char *conname)
82 {
83     ...
84 }
85
86 void
87 usage (const char *programname,
88        const char *modelname,
89        const char *varname,
90        const char *conname)
91 {
92     ...
93 }
94
95 void
96 solveproblem (const char *modelname,
97               const char *varname,
98               const char *conname)
99 {
100    ...
101 }
102
103 void
104 usage (const char *programname,
105        const char *modelname,
106        const char *varname,
107        const char *conname)
108 {
109     ...
110 }
111
112 void
113 solveproblem (const char *modelname,
114               const char *varname,
115               const char *conname)
116 {
117     ...
118 }
119
120 void
121 usage (const char *programname,
122        const char *modelname,
123        const char *varname,
124        const char *conname)
125 {
126     ...
127 }
128
129 void
130 solveproblem (const char *modelname,
131               const char *varname,
132               const char *conname)
133 {
134     ...
135 }
136
137 void
138 usage (const char *programname,
139        const char *modelname,
140        const char *varname,
141        const char *conname)
142 {
143     ...
144 }
145
146 void
147 solveproblem (const char *modelname,
148               const char *varname,
149               const char *conname)
150 {
151     ...
152 }
153
154 void
155 usage (const char *programname,
156        const char *modelname,
157        const char *varname,
158        const char *conname)
159 {
160     ...
161 }
162
163 void
164 solveproblem (const char *modelname,
165               const char *varname,
166               const char *conname)
167 {
168     ...
169 }
170
171 void
172 usage (const char *programname,
173        const char *modelname,
174        const char *varname,
175        const char *conname)
176 {
177     ...
178 }
179
180 void
181 solveproblem (const char *modelname,
182               const char *varname,
183               const char *conname)
184 {
185     ...
186 }
187
188 void
189 usage (const char *programname,
190        const char *modelname,
191        const char *varname,
192        const char *conname)
193 {
194     ...
195 }
196
197 void
198 solveproblem (const char *modelname,
199               const char *varname,
200               const char *conname)
201 {
202     ...
203 }
204
205 void
206 usage (const char *programname,
207        const char *modelname,
208        const char *varname,
209        const char *conname)
210 {
211     ...
212 }
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214 void
215 solveproblem (const char *modelname,
216               const char *varname,
217               const char *conname)
218 {
219     ...
220 }
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222 void
223 usage (const char *programname,
224        const char *modelname,
225        const char *varname,
226        const char *conname)
227 {
228     ...
229 }
230
231 void
232 solveproblem (const char *modelname,
233               const char *varname,
234               const char *conname)
235 {
236     ...
237 }
238
239 void
240 usage (const char *programname,
241        const char *modelname,
242        const char *varname,
243        const char *conname)
244 {
245     ...
246 }
247
248 void
249 solveproblem (const char *modelname,
250               const char *varname,
251               const char *conname)
252 {
253     ...
254 }
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256 void
257 usage (const char *programname,
258        const char *modelname,
259        const char *varname,
260        const char *conname)
261 {
262     ...
263 }
264
265 void
266 solveproblem (const char *modelname,
267               const char *varname,
268               const char *conname)
269 {
270     ...
271 }
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273 void
274 usage (const char *programname,
275        const char *modelname,
276        const char *varname,
277        const char *conname)
278 {
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280 }
281
282 void
283 solveproblem (const char *modelname,
284               const char *varname,
285               const char *conname)
286 {
287     ...
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290 void
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713 }
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715 void
716 usage (const char *programname,
717        const char *modelname,
718        const char *varname,
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720 {
721     ...
722 }
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724 void
725 solveproblem (const char *modelname,
726               const char *varname,
727               const char *conname)
728 {
729     ...
730 }
731
732 void
733 usage (const char *programname,
734        const char *modelname,
735        const char *varname,
736        const char *conname)
737 {
738     ...
739 }
740
741 void
742 solveproblem (const char *modelname,
743               const char *varname,
744               const char *conname)
745 {
746     ...
747 }
748
749 void
750 usage (const char *programname,
751        const char *modelname,
752        const char *varname,
753        const char *conname)
754 {
755     ...
756 }
757
758 void
759 solveproblem (const char *modelname,
760               const char *varname,
761               const char *conname)
762 {
763     ...
764 }
765
766 void
767 usage (const char *programname,
768        const char *modelname,
769        const char *varname,
770        const char *conname)
771 {
772     ...
773 }
774
775 void
776 solveproblem (const char *modelname,
777               const char *varname,
778               const char *conname)
779 {
780     ...
781 }
782
783 void
784 usage (const char *programname,
785        const char *modelname,
786        const char *varname,
787        const char *conname)
788 {
789     ...
790 }
791
792 void
793 solveproblem (const char *modelname,
794               const char *varname,
795               const char *conname)
796 {
797     ...
798 }
799
800 void
801 usage (const char *programname,
802        const char *modelname,
803        const char *varname,
804        const char *conname)
805 {
806     ...
807 }
808
809 void
810 solveproblem (const char *modelname,
811               const char *varname,
812               const char *conname)
813 {
814     ...
815 }
816
817 void
818 usage (const char *programname,
819        const char *modelname,
820        const char *varname,
821        const char *conname)
822 {
823     ...
824 }
825
826 void
827 solveproblem (const char *modelname,
828               const char *varname,
829               const char *conname)
830 {
831     ...
832 }
833
834 void
835 usage (const char *programname,
836        const char *modelname,
837        const char *varname,
838        const char *conname)
839 {
840     ...
841 }
842
843 void
844 solveproblem (const char *modelname,
845               const char *varname,
846               const char *conname)
847 {
848     ...
849 }
850
851 void
852 usage (const char *programname,
853        const char *modelname,
854        const char *varname,
855        const char *conname)
856 {
857     ...
858 }
859
860 void
861 solveproblem (const char *modelname,
862               const char *varname,
863               const char *conname)
864 {
865     ...
866 }
867
868 void
869 usage (const char *programname,
870        const char *modelname,
871        const char *varname,
872        const char *conname)
873 {
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875 }
876
877 void
878 solveproblem (const char *modelname,
879               const char *varname,
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881 {
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885 void
886 usage (const char *programname,
887        const char *modelname,
888        const char *varname,
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890 {
891     ...
892 }
893
894 void
895 solveproblem (const char *modelname,
896               const char *varname,
897               const char *conname)
898 {
899     ...
900 }
901
902 void
903 usage (const char *programname,
904        const char *modelname,
905        const char *varname,
906        const char *conname)
907 {
908     ...
909 }
910
911 void
912 solveproblem (const char *modelname,
913               const char *varname,
914               const char *conname)
915 {
916     ...
917 }
918
919 void
920 usage (const char *programname,
921        const char *modelname,
922        const char *varname,
923        const char *conname)
924 {
925     ...
926 }
927
928 void
929 solveproblem (const char *modelname,
930               const char *varname,
931               const char *conname)
932 {
933     ...
934 }
935
936 void
937 usage (const char *programname,
938        const char *modelname,
939        const char *varname,
940        const char *conname)
941 {
942     ...
943 }
944
945 void
946 solveproblem (const char *modelname,
947               const char *varname,
948               const char *conname)
949 {
950     ...
951 }
952
953 void
954 usage (const char *programname,
955        const char *modelname,
956        const char *varname,
957        const char *conname)
958 {
959     ...
960 }
961
962 void
963 solveproblem (const char *modelname,
964               const char *varname,
965               const char *conname)
966 {
967     ...
968 }
969
970 void
971 usage (const char *programname,
972        const char *modelname,
973        const char *varname,
974        const char *conname)
975 {
976     ...
977 }
978
979 void
980 solveproblem (const char *modelname,
981               const char *varname,
982               const char *conname)
983 {
984     ...
985 }
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987 void
988 usage (const char *programname,
989        const char *modelname,
990        const char *varname,
991        const char *conname)
992 {
993     ...
994 }
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996 void
997 solveproblem (const char *modelname,
998               const char *varname,
999               const char *conname)
1000 {
1001     ...
1002 }
1003
1004 void
1005 usage (const char *programname,
1006        const char *modelname,
1007        const char *varname,
1008        const char *conname)
1009 {
1010     ...
1011 }
1012
1013 void
1014 solveproblem (const char *modelname,
1015               const char *varname,
1016               const char *conname)
1017 {
1018     ...
1019 }
1020
1021 void
1022 usage (const char *programname,
1023        const char *modelname,
1024        const char *varname,
1025        const char *conname)
1026 {
1027     ...
1028 }
1029
1030 void
1031 solveproblem (const char *modelname,
1032               const char *varname,
1033               const char *conname)
1034 {
1035     ...
1036 }
1037
1038 void
1039 usage (const char *programname,
1040        const char *modelname,
1041        const char *varname,
1042        const char *conname)
1043 {
1044     ...
1045 }
1046
1047 void
1048 solveproblem (const char *modelname,
1049               const char *varname,
1050               const char *conname)
1051 {
1052     ...
1053 }
1054
1055 void
1056 usage (const char *programname,
1057        const char *modelname,
1058        const char *varname,
1059        const char *conname)
1060 {
1061     ...
1062 }
1063
1064 void
1065 solveproblem (const char *modelname,
1066               const char *varname,
1067               const char *conname)
1068 {
1069     ...
1070 }
1071
1072 void
1073 usage (const char *programname,
1074        const char *modelname,
1075        const char *varname,
1076        const char *conname)
1077 {
1078     ...
1079 }
1080
1081 void
1082 solveproblem (const char *modelname,
1083               const char *varname,
1084               const char *conname)
1085 {
1086     ...
1087 }
1088
1089 void
1090 usage (const char *programname,
1091        const char *modelname,
1092        const char *varname,
1093        const char *conname)
1094 {
1095     ...
1096 }
1097
1098 void
1099 solveproblem (const char *modelname,
1100               const char *varname,
1101               const char *conname)
1102 {
1103     ...
1104 }
1105
1106 void
1107 usage (const char *programname,
1108        const char *modelname,
1109        const char *varname,
1110        const char *conname)
1111 {
1112     ...
1113 }
1114
1115 void
1116 solveproblem (const char *modelname,
1117               const char *varname,
1118               const char *conname)
1119 {
1120     ...
1121 }
1122
1123 void
1124 usage (const char *programname,
1125        const char *modelname,
1126        const char *varname,
1127        const char *conname)
1128 {
1129     ...
1130 }
1131
1132 void
1133 solveproblem (const char *modelname,
1134               const char *varname,
1135               const char *conname)
1136 {
1137     ...
1138 }
1139
1140 void
1141 usage (const char *programname,
1142        const char *modelname,
1143        const char *varname,
1144        const char *conname)
1145 {
1146     ...
1147 }
1148
1149 void
1150 solveproblem (const char *modelname,
1151               const char *varname,
1152               const char *conname)
1153 {
1154     ...
1155 }
1156
1157 void
1158 usage (const char *programname,
1159        const char *modelname,
1160        const char *varname,
1161        const char *conname)
1162 {
1163     ...
1164 }
1165
1166 void
1167 solveproblem (const char *modelname,
1168               const char *varname,
1169               const char *conname)
1170 {
1171     ...
1172 }
1173
1174 void
1175 usage (const char *programname,
1176        const char *modelname,
1177        const char *varname,
1178        const char *conname)
1179 {
1180     ...
1181 }
1182
1183 void
1184 solveproblem (const char *modelname,
1185               const char *varname,
1186               const char *conname)
1187 {
1188     ...
1189 }
1190
1191 void
1192 usage (const char *programname,
1193        const char *modelname,
1194        const char *varname,
1195        const char *conname)
1196 {
1197     ...
1198 }
1199
1200 void
1201 solveproblem (const char *modelname,
1202               const char *varname,
1203               const char *conname)
1204 {
1205     ...
1206 }
1207
1208 void
1209 usage (const char *programname,
1210        const char *modelname,
1211        const char *varname,
1212        const char *conname)
1213 {
1214     ...
1215 }
1216
1217 void
1218 solveproblem (const char *modelname,
1219               const char *varname,
1220               const char *conname)
1221 {
1222     ...
1223 }
1224
1225 void
1226 usage (const char *programname,
1227        const char *modelname,
1228        const char *varname,
1229        const char *conname)
1230 {
1231     ...
1232 }
1233
1234 void
1235 solveproblem (const char *modelname,
1236               const char *varname,
1237               const char *conname)
1238 {
1239     ...
1240 }
1241
1242 void
1243 usage (const char *programname,
1244        const char *modelname,
1245        const char *varname,
1246        const char *conname)
1247 {
1248     ...
1249 }
1250
1251 void
1252 solveproblem (const char *modelname,
1253               const char *varname,
1254               const char *conname)
1255 {
1256     ...
1257 }
1258
1259 void
1260 usage (const char *programname,
1261        const char *modelname,
1262        const char *varname,
1263        const char *conname)
1264 {
1265     ...
1266 }
1267
1268 void
1269 solveproblem (const char *modelname,
1270               const char *varname,
1271               const char *conname)
1272 {
1273     ...
1274 }
1275
1276 void
1277 usage (const char *programname,
1278        const char *modelname,
1279        const char *varname,
1280        const char *conname)
1281 {
1282     ...
1283 }
1284
1285 void
1286 solveproblem (const char *modelname,
1287               const char *varname,
1288               const char *conname)
1289 {
1290     ...
1291 }
1292
1293 void
1294 usage (const char *programname,
1295        const char *modelname,
1296        const char *varname,
1297        const char *conname)
1298 {
1299     ...
1300 }
1301
1302 void
1303 solveproblem (const char *modelname,
1304               const char *varname,
1305               const char *conname)
1306 {
1307     ...
1308 }
1309
1310 void
1311 usage (const char *programname,
1312        const char *modelname,
1313        const char *varname,
1314        const char *conname)
1315 {
1316     ...
1317 }
1318
1319 void
1320 solveproblem (const char *modelname,
1321               const char *varname,
1322               const char *conname)
1323 {
1324     ...
1325 }
1326
1327 void
1328 usage (const char *programname,
1329        const char *modelname,
1330        const char *varname,
1331        const char *conname)
1332 {
1333     ...
1334 }
1335
1336 void
1337 solveproblem (const char *modelname,
1338               const char *varname,
1339               const char *conname)
1340 {
1341     ...
1342 }
1343
1344 void
1345 usage (const char *programname,
1346        const char *modelname,
1347        const char *varname,
1348        const char *conname)
1349 {
1350     ...
1351 }
1352
1353 void
1354 solveproblem (const char *modelname,
1355               const char *varname,
1356               const char *conname)
1357 {
1358     ...
1359 }
1360
1361 void
1362 usage (const char *programname,
1363        const char *modelname,
1364        const char *varname,
1365        const char *conname)
1366 {
1367     ...
1368 }
1369
1370 void
1371 solveproblem (const char *modelname,
1372               const char *varname,
1373               const char *conname)
1374 {
1375     ...
1376 }
1377
1378 void
1379 usage (const char *programname,
1380        const char *modelname,
1381        const char *varname,
1382        const char *conname)
1383 {
1384     ...
1385 }
1386
1387 void
1388 solveproblem (const char *modelname,
1389               const char *varname,
1390               const char *conname)
1391 {
1392     ...
1393 }
1394
1395 void
1396 usage (const char *programname,
1397        const char *modelname,
1398        const char *varname,
1399        const char *conname)
1400 {
1401     ...
1402 }
1403
1404 void
1405 solveproblem (const char *modelname,
1406               const char *varname,
1407               const char *conname)
1408 {
1409     ...
1410 }
1411
1412 void
1413 usage (const char *programname,
1414        const char *modelname,
1415        const char *varname,
1416        const char *conname)
1417 {
1418     ...
1419 }
1420
1421 void
1422 solveproblem (const char *modelname,
1423               const char *varname,
1424               const char *conname)
1425 {
1426     ...
1427 }
1428
1429 void
1430 usage (const char *programname,
1431        const char *modelname,
1432        const char *varname,
1433        const char *conname)
1434 {
1435     ...
1436 }
1437
1438 void
1439 solveproblem (const char *modelname,
1440               const char *varname,
1441               const char *conname)
1442 {
1443     ...
1444 }
1445
1446 void
1447 usage (const char *programname,
1448        const char *modelname,
1449        const char *varname,
1450        const char *conname)
1451 {
1452     ...
1453 }
1454
1455 void
1456 solveproblem (const char *modelname,
1457               const char *varname,
1458               const char *conname)
1459 {
1460     ...
1461 }
1462
1463 void
1464 usage (const char *programname,
1465        const char *modelname,
1466        const char *
```

We then build the actual file, and a command prompt window will feedback the right execution here (this is a different execution, the example run in the laboratory, so you have an idea):

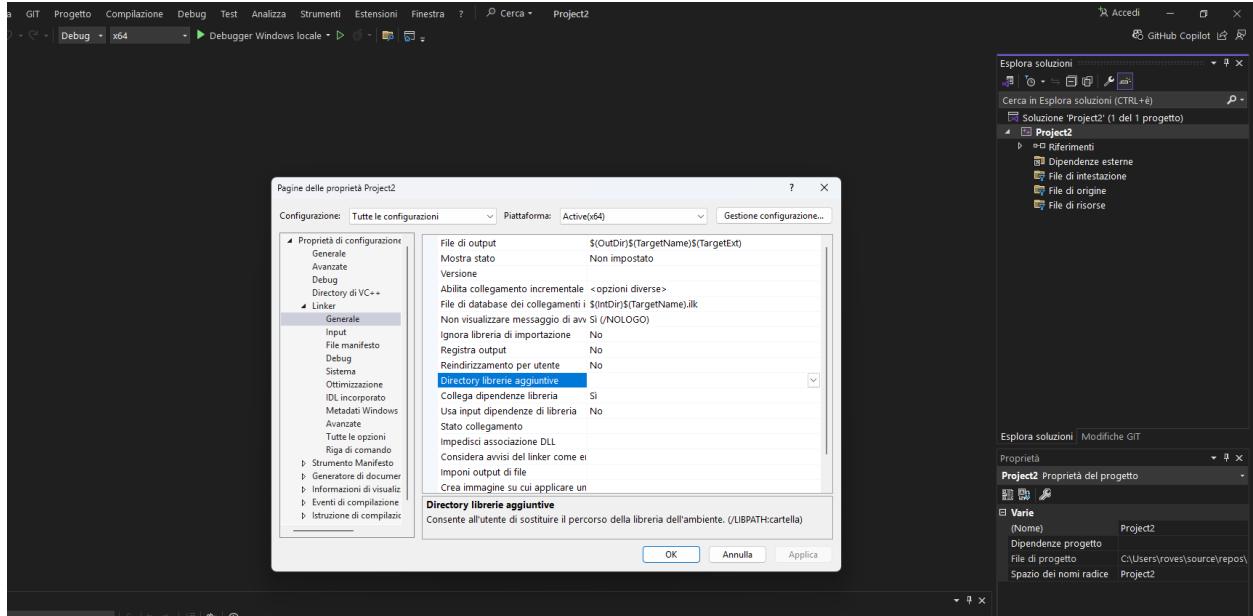
```
1  */
2  * @file moving_scaffolds.cpp
3  * @brief ...
4  */
5
6  #include <iostream>
7  #include <cmath>
8  #include <vector>
9
10 // Using namespace std;
11
12 // extern "C" {
13 int solve();
14 char exit_code;
15
16 // Data structures
17 const int A2 = 5000;
18 const int A3 = 2000;
19 const int B1 = 6000;
20 const int B2 = 0;
21 const int C1 = 2000;
22 const int C2 = 0;
23 const int C3 = 2000;
24
25 // Truck values
26 const int y_A2 = 1;
27 const int y_A3 = 1;
28 const int y_B1 = 1;
29 const int y_B2 = 0;
30 const int y_C1 = 1;
31 const int y_C2 = -0;
32 const int y_C3 = 1;
33
34 // Additional truck z = -0
35
36 // Press any key to continue...
37
38 output dir: Comp
```

This way, any kind of project works. This was tested both on C and C++ files.

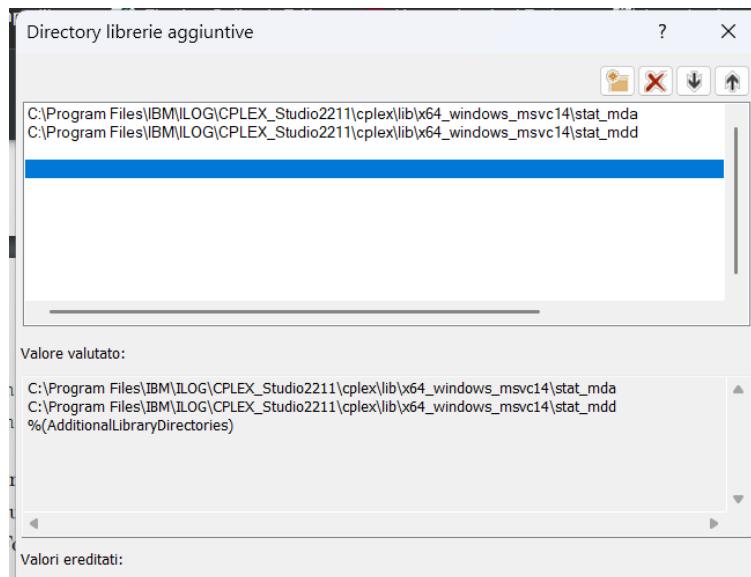
4 WINDOWS CPLEX COMPILED – SOLUTION 2

Another way to make this work is to create a C++ project from scratch and then right click on the right side menu on Properties so to open the following window – adapted from 4-5 page of [this](#).

Then, one goes to “Linker” > “General” > “Additional library directories”:



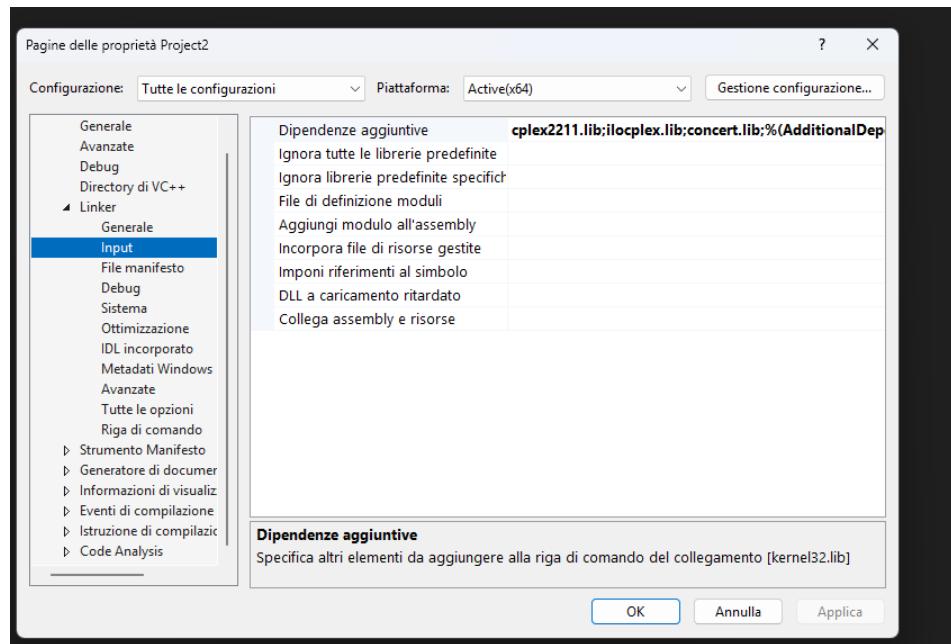
Here, one then adds the mda/mdd folders as path:



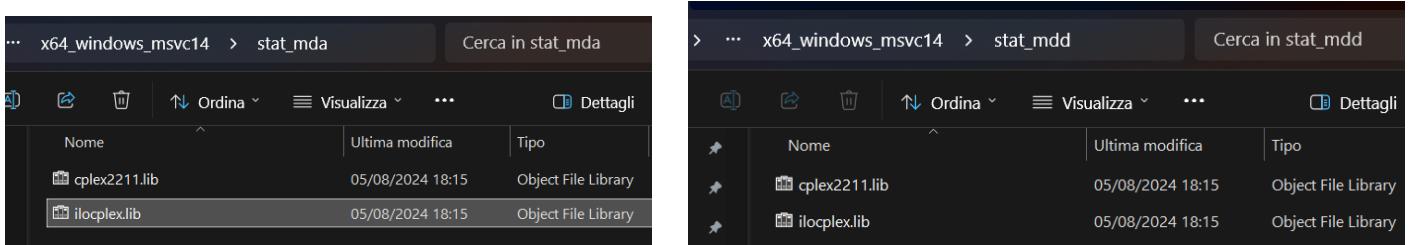
which are:, I remember:

```
C:\Program  
Files\IBM\ILOG\CPLEX_Studio2211\cplex\lib\x64_windows_msvc14\stat_mdd  
C:\Program  
Files\IBM\ILOG\CPLEX_Studio2211\cplex\lib\x64_windows_msvc14\stat_mda
```

Then, in the “Linker” > “Input” tab, click on “Additional dependencies”:



Add all of the files which are .lib files inside of the mda/mdd folders:



They are `concert.lib` (concert directory of before and the two above files), separated with a semicolon when inserted:

