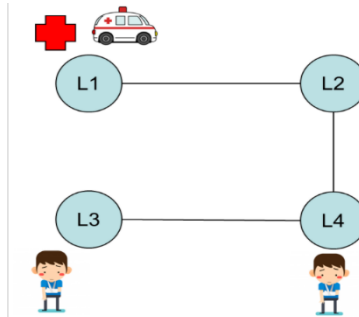


## Caso 1.

Para el primer caso se desarrolla el código para la ejecución del siguiente diagrama de flujo, con ubicaciones ya definidas.



La ambulancia deberá seguir la ruta L1-L2 para recoger al paciente y L2-L1 para llevarlo al hospital, siguiendo la misma lógica para recoger al paciente 2.

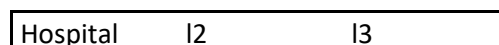
La ejecución del planner en VSCode nos arroja lo siguiente.

```
■ manejar I1 I2
■ manejar I2 I4
■ subir-paciente p1 I4 I3 amb
■ manejar I4 I2
■ manejar I2 I1
■ bajar-paciente p1 I1 I2 amb
■ manejar I1 I2
■ manejar I2 I4
■ manejar I4 I3
■ subir-paciente p2 I3 I4 amb
■ manejar I3 I4
■ manejar I4 I2
■ manejar I2 I1
■ bajar-paciente p2 I1 I2 amb
```

## Caso 2.

Para el segundo caso, se le definen rutas a las cuales el planificador puede elegir, creando rutas a las cuales no puede acceder, simulando un obstáculo. Al igual que en el primero, tiene que recoger a 2 pacientes, pero en este caso, el planificador decide la ruta.

El “mapa” que podemos hacer es el siguiente.



I4	I5	I6
I7	I8	I9
p2	I11	p1

La ejecución del planner en VSCode nos arroja lo siguiente.

```

■ manejar I1 I2
■ manejar I2 I6
■ manejar I6 I9
■ manejar I9 I11
■ manejar I11 I12
■ subir-paciente p2 I12 I9 amb
■ manejar I12 I9
■ manejar I9 I6
■ manejar I6 I2
■ manejar I2 I1
■ bajar-paciente p2 I1 I2 amb
■ manejar I1 I2
■ manejar I2 I6
■ manejar I6 I9
■ manejar I9 I11
■ manejar I11 I10
■ subir-paciente p1 I10 I11 amb
■ manejar I10 I11
■ manejar I11 I9
■ manejar I9 I6
■ manejar I6 I2
■ manejar I2 I1
■ bajar-paciente p1 I1 I2 amb

```

### Caso 3.

Para el tercer planner, se realizó un “mapa” más grande, con la finalidad de ver si toma una ruta que sea optima y no tarde tanto tiempo en llegar al paciente y dejarlo en el hospital. Con esto podríamos decir si el planner es inteligente o solamente realiza movimientos al azar.

El “mapa” generado es el siguiente.

Hospital	I2	I3	I4	I5
I6	I7	I8	I9	I10
I11	I12	I13	I14	I15
I16	I17	I18	I19	I20
I21	I22	I23	I24	I25

I26	I27	I28	I29	I30
I31	I32	I33	I34	I35
I36	I37	I38	I39	I40
I41	I42	I43	I44	I45
I46	I47	I48	I49	p1

La ejecución del planner en VSCode nos arroja lo siguiente.

```

■ manejar I1 I6
■ manejar I6 I12
■ manejar I12 I18
■ manejar I18 I23
■ manejar I23 I28
■ manejar I28 I33
■ manejar I33 I38
■ manejar I38 I43
■ manejar I43 I49
■ manejar I49 I50
■ subir-paciente p1 I50 I45 amb
■ manejar I50 I49
■ manejar I49 I43
■ manejar I43 I38
■ manejar I38 I33
■ manejar I33 I28
■ manejar I28 I23
■ manejar I23 I18
■ manejar I18 I12
■ manejar I12 I6
■ manejar I6 I1
■ bajar-paciente p1 I1 I6 amb

```

## Implementación del planner de la competencia.

```
carlos@carlos-VirtualBox: ~  
y sc  
0 upgraded, 174 newly installed, 0 to remove and 0 not upgraded.  
Need to get 123 MB of archives.  
After this operation, 449 MB of additional disk space will be used.  
Get:1 http://archive.ubuntu.com/ubuntu xenial/main amd64 libatm1 amd64 1:2.5.1-1.5 [24.2 kB]  
Get:2 http://archive.ubuntu.com/ubuntu xenial/main amd64 libnls0 amd64 1:0.3-5 [12.0 kB]  
Get:3 http://archive.ubuntu.com/ubuntu xenial/main amd64 libpopt0 amd64 1:1.16-10 [26.0 kB]  
Get:4 http://archive.ubuntu.com/ubuntu xenial/main amd64 libgdbm3 amd64 1.8.3-13.1 [16.9 kB]  
Get:5 http://archive.ubuntu.com/ubuntu xenial/main amd64 libxau6 amd64 1:1.0.8-1 [8376 B]  
Get:6 http://archive.ubuntu.com/ubuntu xenial/main amd64 libxdmcp6 amd64 1:1.1.2-1.1 [11.0 kB]  
Get:7 http://archive.ubuntu.com/ubuntu xenial/main amd64 libxcb1 amd64 1:1.11-1ubuntu1 [40.0 kB]  
Get:8 http://archive.ubuntu.com/ubuntu xenial-updates/main amd64 libx11-data all 2:1.6.3-1ubuntu2 [114 kB]  
Get:9 http://archive.ubuntu.com/ubuntu xenial-updates/main amd64 libx11-6 amd64 2:1.6.3-1ubuntu2 [572 kB]  
Get:10 http://archive.ubuntu.com/ubuntu xenial/main amd64 libxext6 amd64 2:1.3.3-1 [29.4 kB]  
Get:11 http://archive.ubuntu.com/ubuntu xenial/main amd64 sgml-base all 1:2.6+nmu4ubuntu1 [12.5 kB]  
Get:12 http://archive.ubuntu.com/ubuntu xenial-updates/main amd64 cmake-data all 3.5.1-1ubuntu3 [1121 kB]  
Get:13 http://archive.ubuntu.com/ubuntu xenial/main amd64 liblz0-2 amd64 4.2.0.8-1.2 [48.7 kB]  
Get:14 http://archive.ubuntu.com/ubuntu xenial-updates/main amd64 libnettle6 amd64 3.2-1ubuntu0.16.04.2 [93.7 kB]  
Get:15 http://archive.ubuntu.com/ubuntu xenial-updates/main amd64 libicu55 amd64 55.1-7ubuntu0.5 [7650 kB]  
7% [15 libicu55 5903 kB/7650 kB 77%] 433 kB/s 4m1n 24s  
y files?
```

```
carlos@carlos-VirtualBox: ~  
y sc  
Unpacking libcurl3-gnutls:amd64 (7.47.0-1ubuntu2.19) ...  
Selecting previously unselected package libedit2:amd64.  
Preparing to unpack .../libedit2_3.1-20150325-1ubuntu2_amd64.deb ...  
Unpacking libedit2:amd64 (3.1-20150325-1ubuntu2) ...  
Selecting previously unselected package libssl2-modules:amd64.  
Preparing to unpack .../libssl2-modules_2.1.26.dfsg1-14ubuntu0.2_amd64.deb ...  
Unpacking libssl2-modules:amd64 (2.1.26.dfsg1-14ubuntu0.2) ...  
Selecting previously unselected package libxmu1:amd64.  
Preparing to unpack .../libxmu1_2:3.1.1-2-2_amd64.deb ...  
Unpacking libxmu1:amd64 (2:3.1.1-2-2) ...  
Selecting previously unselected package manpages.  
Preparing to unpack .../manpages_4.04-2_all.deb ...  
Unpacking manpages (4.04-2) ...  
Selecting previously unselected package openssh-client.  
Preparing to unpack .../openssh-client_1:3.9p2-4ubuntu2.10_amd64.deb ...  
Unpacking openssh-client (1:7.2p2-4ubuntu2.10) ...  
Selecting previously unselected package rsync.  
Preparing to unpack .../rsync_3.1.1-3ubuntu1.3_amd64.deb ...  
Unpacking rsync (3.1.1-3ubuntu1.3) ...  
Selecting previously unselected package xauth.  
Preparing to unpack .../xauth_1:1.0.9-1ubuntu2_amd64.deb ...  
Unpacking xauth (1:1.0.9-1ubuntu2) ...  
Selecting previously unselected package xml-core.  
Preparing to unpack .../xml-core_0.13+nmu2_all.deb ...  
Unpacking xml-core (0.13+nmu2) ...  
Selecting previously unselected package binutils.  
Preparing to unpack .../binutils_2.26.1-1ubuntu1-16.04.8_amd64.deb ...  
Unpacking binutils (2.26.1-1ubuntu1-16.04.8) ...  
Selecting previously unselected package libc-dev-bin.  
Preparing to unpack .../libc-dev-bin_2.23-0ubuntu1.3_amd64.deb ...  
Unpacking libc-dev-bin (2.23-0ubuntu1.3) ...  
Progress: [ 32%] [#####] .....  
y files?
```

```
carlos@carlos-VirtualBox: ~  
y sc  
g++ -Iext -I32 -std=c++11 -Wall -W -Wno-sign-compare -Wno-deprecated -pe  
dantic -Werror -DSTATE_VAR_BYTES=4 -Icudd-2.5.0/include -O3 -DNDEBUG -fo  
mt-frame-pointer -c axioms.cc -o .obj/axioms.4.o  
g++ -Iext -I32 -std=c++11 -Wall -W -Wno-sign-compare -Wno-deprecated -pe  
dantic -Werror -DSTATE_VAR_BYTES=4 -Icudd-2.5.0/include -O3 -DNDEBUG -fo  
mt-frame-pointer -c causal_graph.cc -o .obj/causal_graph.4.o  
g++ -Iext -I32 -std=c++11 -Wall -W -Wno-sign-compare -Wno-deprecated -pe  
dantic -Werror -DSTATE_VAR_BYTES=4 -Icudd-2.5.0/include -O3 -DNDEBUG -fo  
n.pmt-frame-pointer -c combining_evaluator.cc -o .obj/combining_evaluator.  
em.4.o  
g++ -Iext -I32 -std=c++11 -Wall -W -Wno-sign-compare -Wno-deprecated -pe  
dantic -Werror -DSTATE_VAR_BYTES=4 -Icudd-2.5.0/include -O3 -DNDEBUG -fo  
pmt-frame-pointer -c domain_transition_graph.cc -o .obj/domain_transitio  
R/n_graph.4.o  
g++ -Iext -I32 -std=c++11 -Wall -W -Wno-sign-compare -Wno-deprecated -pe  
dantic -Werror -DSTATE_VAR_BYTES=4 -Icudd-2.5.0/include -O3 -DNDEBUG -fo  
mt-frame-pointer -c eager_search.cc -o .obj/eager_search.4.o  
g++ -Iext -I32 -std=c++11 -Wall -W -Wno-sign-compare -Wno-deprecated -pe  
dantic -Werror -DSTATE_VAR_BYTES=4 -Icudd-2.5.0/include -O3 -DNDEBUG -fo  
mt-frame-pointer -c enforced_hill_climbing_search.cc -o .obj/enforced_h  
ill_climbing_search.4.o  
g++ -Iext -I32 -std=c++11 -Wall -W -Wno-sign-compare -Wno-deprecated -pe  
dantic -Werror -DSTATE_VAR_BYTES=4 -Icudd-2.5.0/include -O3 -DNDEBUG -fo  
ect-frame-pointer -c exact_titer.cc -o .obj/exact_titer.4.o  
g++ -Iext -I32 -std=c++11 -Wall -W -Wno-sign-compare -Wno-deprecated -pe  
dantic -Werror -DSTATE_VAR_BYTES=4 -Icudd-2.5.0/include -O3 -DNDEBUG -fo  
mt-frame-pointer -c g_evaluator.cc -o .obj/g_evaluator.4.o  
g++ -Iext -I32 -std=c++11 -Wall -W -Wno-sign-compare -Wno-deprecated -pe  
dantic -Werror -DSTATE_VAR_BYTES=4 -Icudd-2.5.0/include -O3 -DNDEBUG -fo  
mt-frame-pointer -c globals.cc -o .obj/globals.4.o  
g++ -Iext -I32 -std=c++11 -Wall -W -Wno-sign-compare -Wno-deprecated -pe  
dantic -Werror -DSTATE_VAR_BYTES=4 -Icudd-2.5.0/include -O3 -DNDEBUG -fo  
mt-frame-pointer -c heuristic.cc -o .obj/heuristic.4.o  
y files?
```

```
carlos@carlos-VirtualBox: ~  
y sc  
[ 13%] Building CXX object search/CHakeFiles/downward.dir/potentials/uti  
cc.o  
[ 14%] Building CXX object search/CHakeFiles/downward.dir/potentials/sin  
gle_potential_heuristics.cc.o  
[ 14%] Building CXX object search/CHakeFiles/downward.dir/potentials/san  
ple_based_potential_heuristics.cc.o  
[ 14%] Building CXX object search/CHakeFiles/downward.dir/potentials/pot  
ential_optimizer.cc.o  
[ 15%] Building CXX object search/CHakeFiles/downward.dir/potentials/pot  
ential_max_heuristic.cc.o  
[ 15%] Building CXX object search/CHakeFiles/downward.dir/potentials/pot  
ential_heuristic.cc.o  
[ 16%] Building CXX object search/CHakeFiles/downward.dir/potentials/pot  
ential_function.cc.o  
[ 16%] Building CXX object search/CHakeFiles/downward.dir/potentials/div  
erse_potential_heuristics.cc.o  
[ 16%] Building CXX object search/CHakeFiles/downward.dir/pdbs/zero_one  
pdbs_heuristic.cc.o  
[ 17%] Building CXX object search/CHakeFiles/downward.dir/pdbs/zero_one  
pdbs.cc.o  
[ 17%] Building CXX object search/CHakeFiles/downward.dir/pdbs/validatio  
n.cc.o  
[ 18%] Building CXX object search/CHakeFiles/downward.dir/pdbs/pdb_heur  
istic.cc.o  
[ 18%] Building CXX object search/CHakeFiles/downward.dir/pdbs/pattern_g  
enerator.cc.o  
[ 18%] Building CXX object search/CHakeFiles/downward.dir/pdbs/pattern_g  
enerator_manual.cc.o  
[ 19%] Building CXX object search/CHakeFiles/downward.dir/pdbs/pattern_g  
enerator_greedy.cc.o  
[ 19%] Building CXX object search/CHakeFiles/downward.dir/pdbs/pattern_c  
ollection_generator_systematic.cc.o  
[ 20%] Building CXX object search/CHakeFiles/downward.dir/pdbs/pattern_c  
ollection_generator_manual.cc.o  
y files?
```

```
carlos@carlos-VirtualBox:~$ RUNDIR=$(pwd)/rundir
carlos@carlos-VirtualBox:~$ DOMAIN=$(RUNDIR/domain.pddl)
carlos@carlos-VirtualBox:~$ PROBLEM=$(RUNDIR/problem.pddl)
carlos@carlos-VirtualBox:~$ PLANFILE=$(RUNDIR/sas_plan)
carlos@carlos-VirtualBox:~$ COSTBOUND=42 # only in cost-bounded track
carlos@carlos-VirtualBox:~$ ulimit -t 1800
carlos@carlos-VirtualBox:~$ ulimit -v 8388608
carlos@carlos-VirtualBox:~$ singularity run -C -H $RUNDIR planner.img $D
MAIN $PROBLEM $PLANFILE $COSTBOUND
```

```
pattern: [80, 96, 99, 107, 108, 111, 113, 116, 117, 118, 119, 120, 121,
122] - Improvement: 4
pattern: [80, 99, 101, 107, 108, 111, 113, 116, 117, 118, 119, 120, 121,
122] - Improvement: 5
pattern: [80, 99, 102, 107, 108, 111, 113, 116, 117, 118, 119, 120, 121,
122] - Improvement: 3
pattern: [80, 99, 103, 107, 108, 111, 113, 116, 117, 118, 119, 120, 121,
122] - Improvement: 1
pattern: [80, 99, 104, 107, 108, 111, 113, 116, 117, 118, 119, 120, 121,
122] - Improvement: 2
pattern: [80, 99, 105, 107, 108, 111, 113, 116, 117, 118, 119, 120, 121,
122] - Improvement: 3
pattern: [80, 99, 107, 108, 110, 111, 113, 116, 117, 118, 119, 120, 121,
122] - Improvement: 2
pattern: [80, 99, 107, 108, 111, 113, 115, 116, 117, 118, 119, 120, 121,
122] - Improvement: 2
pattern: [80, 85, 99, 107, 108, 111, 113, 116, 117, 118, 119, 120, 121,
122] - Improvement: 11
pattern: [80, 88, 99, 107, 108, 111, 113, 116, 117, 118, 119, 120, 121,
122] - Improvement: 16
pattern: [80, 99, 100, 107, 108, 111, 113, 116, 117, 118, 119, 120, 121,
122] - Improvement: 6
found a better pattern with improvement 16
pattern: [80, 88, 107, 108, 113, 116, 117, 118, 120]
Command '['/planner/builds/release64/bin/downward', '--symmetries', 'sym
asstructural_symmetries(search_symmetries=dks)', '--search', 'astar(cpdbs
(patterns=hillclimb(max_time=900),transform=multiply_out_conditional_
effects),symmetries=syn,pruning=stubborn_sets_stmple(minimum_pruning_rat
io=0.01),num_por_probes=1000)', '--internal-plan-file', '/home/carlos/ru
ndir/sas_plan']' returned non-zero exit status -9
Overall time: [442.220s CPU, 606.162s wall-clock]

==== Done running the selected planner. ====
carlos@carlos-VirtualBox:~$
```

Archivos resultantes.

