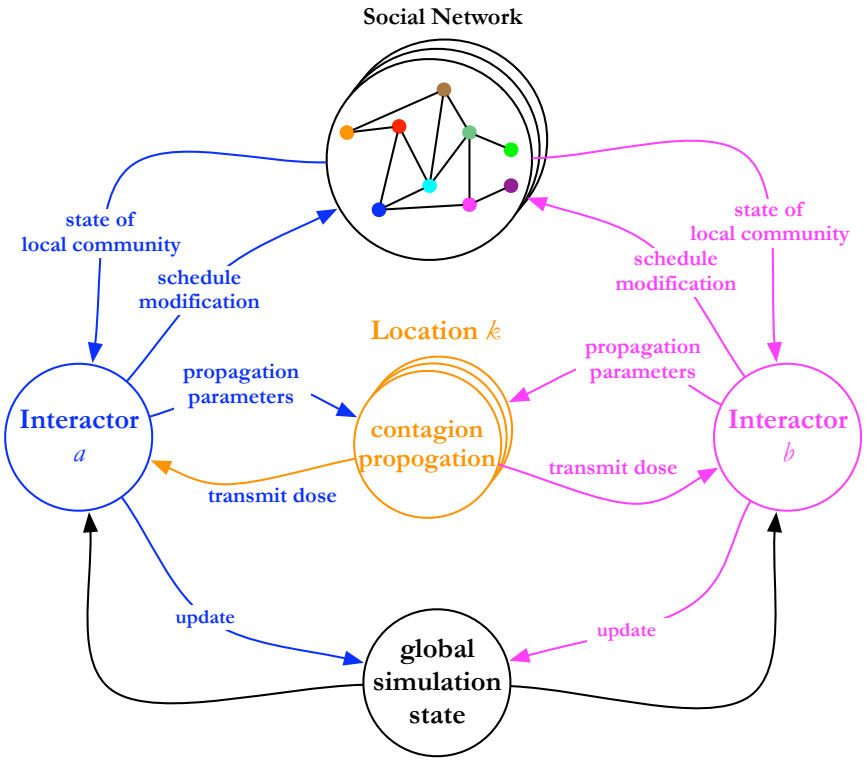
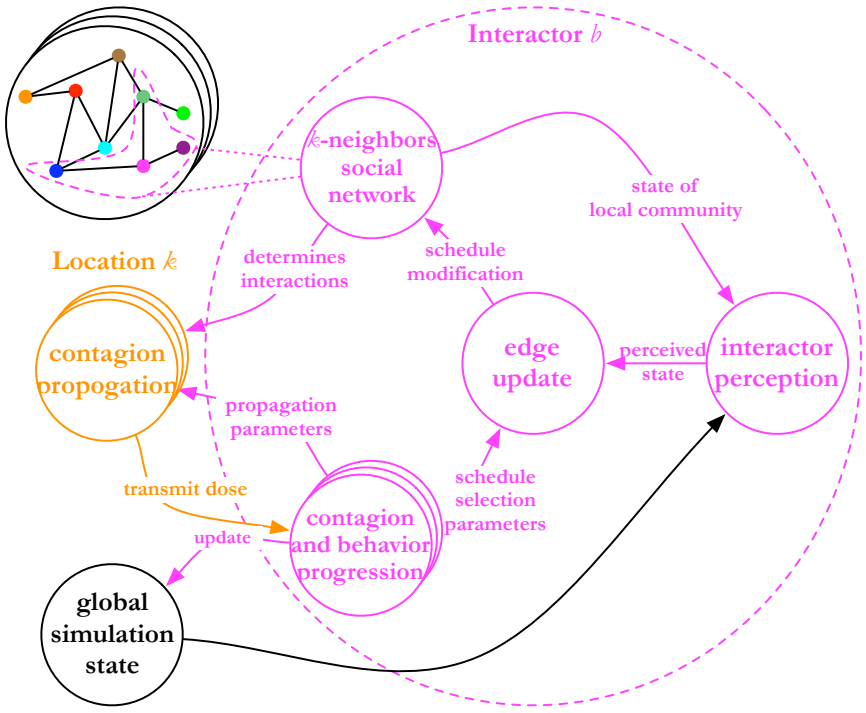
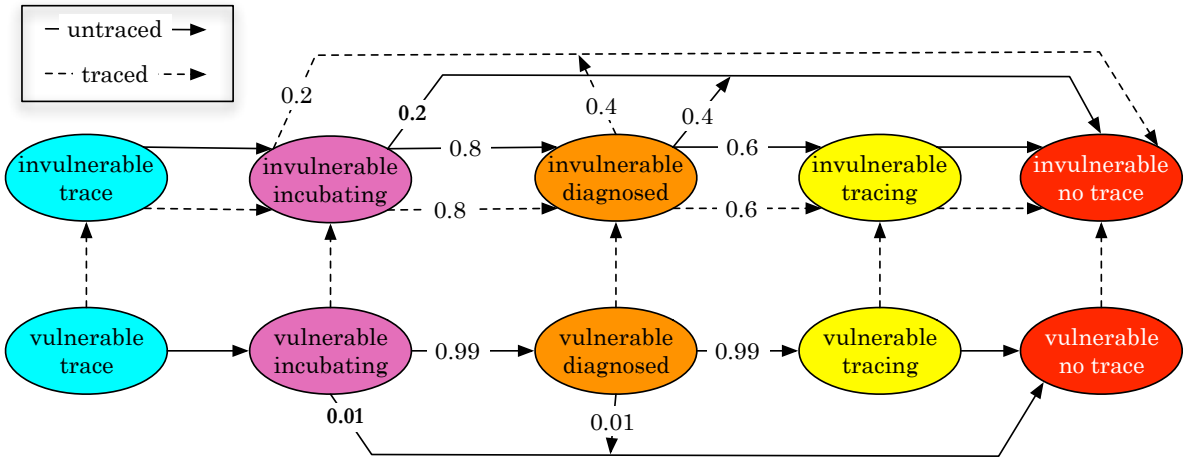
EpiSimdemics 2.0





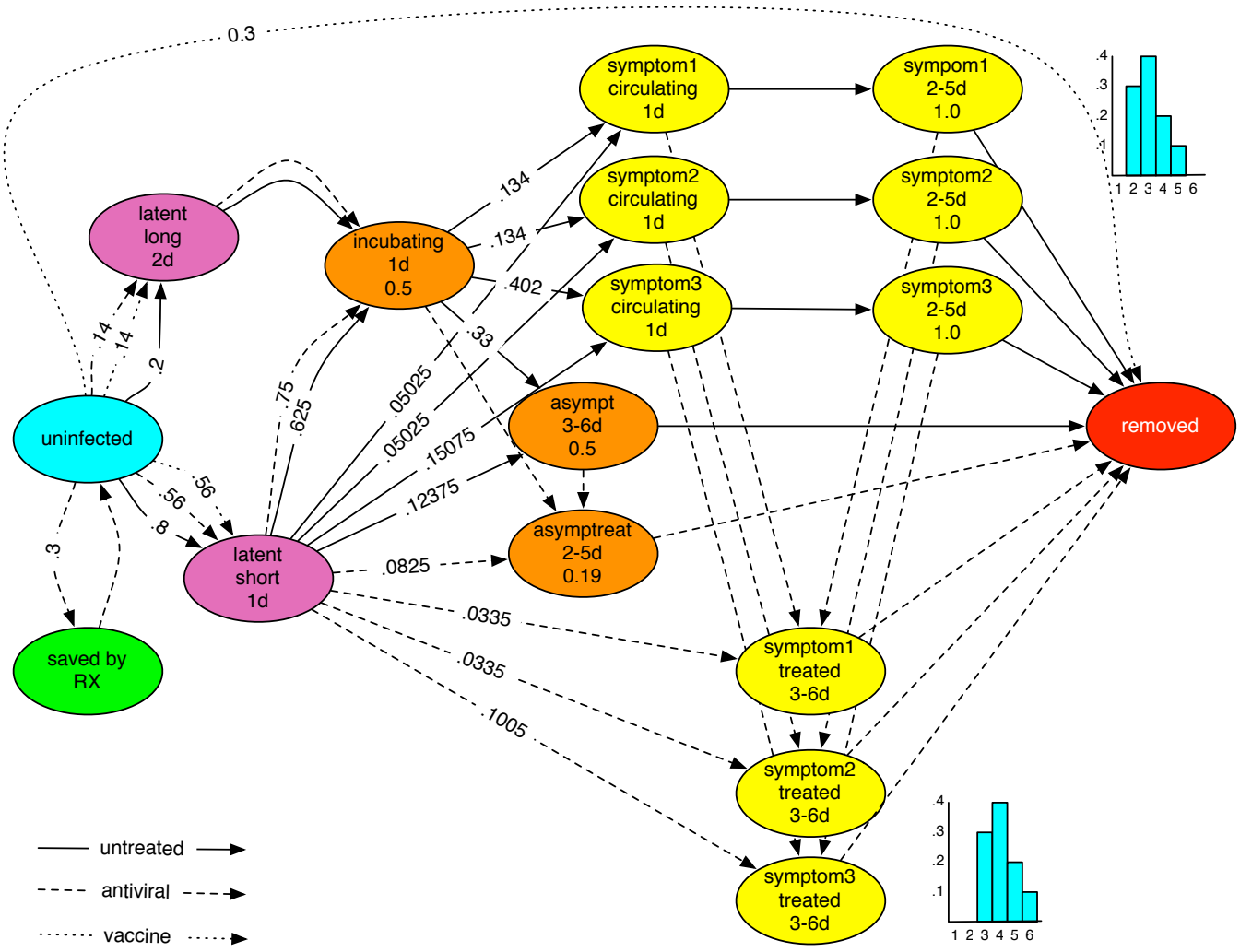
Example FSM




```
DISEASE_MANIFESTATION invulnerable
   DISEASE_STATE trace Forever 0 0 0.0 0.0 0
      DISEASE_LINK "untraced" 1.0 incubating
      DISEASE_LINK "traced"   1.0 incubating
   DISEASE_STATE incubating Uniform 24:00:00 24:00:00 0 0 0.0 0.0 0
      DISEASE_LINK "untraced" 0.8 diagnosed
      DISEASE_LINK "untraced" 0.2 notrace
      DISEASE_LINK "traced"   0.8 diagnosed
      DISEASE_LINK "traced"   0.2 notrace
   DISEASE_STATE diagnosed Uniform 24:00:00 24:00:00 0 0 0.0 0.0 0
      DISEASE_LINK "untraced" 0.6 tracing
      DISEASE_LINK "untraced" 0.4 notrace
      DISEASE_LINK "traced"   0.6 tracing
      DISEASE_LINK "traced"   0.4 notrace
   DISEASE_STATE tracing Uniform  240:00:00 240:00:00 0 0 1.0 0.0 0
      DISEASE_LINK "untraced" 1.0 notrace
      DISEASE_LINK "traced"   1.0 notrace
   DISEASE_STATE notrace Forever 0 0 0.0 0.0 0

DISEASE_MANIFESTATION vulnerable
   DISEASE_STATE trace Forever 0 0 0.0 1.0 0
      DISEASE_LINK "untraced" 1.0 incubating
      DISEASE_LINK "traced"   1.0 trace invulnerable
   DISEASE_STATE incubating Uniform 24:00:00 24:00:00 0 0 0.0 1.0 0
      DISEASE_LINK "untraced" 0.99 diagnosed
      DISEASE_LINK "untraced" 0.01 notrace
      DISEASE_LINK "traced"   1.0 incubating invulnerable
   DISEASE_STATE diagnosed Uniform 24:00:00 24:00:00 0 0 0.0 1.0 0
      DISEASE_LINK "untraced" 0.99 tracing
      DISEASE_LINK "untraced" 0.01 notrace
      DISEASE_LINK "traced"   1.0 diagnosed invulnerable
   DISEASE_STATE tracing Uniform  240:00:00 240:00:00 0 0 1.0 1.0 0
      DISEASE_LINK "untraced" 1.0 notrace
      DISEASE_LINK "traced"   1.0 tracing invulnerable
   DISEASE_STATE notrace Forever 0 0 0.0 1.0 0
      DISEASE_LINK "traced"   1.0 notrace invulnerable
```

H5N1 Disease Model



Example Configuration File

```
# Variables for use in config file
$OUTPUTDIR            /home/kbisset/scenarios/portland_survey/output
$DATADIR              /home/kbisset/scenarios/portland_survey

LOG_LEVEL             INFO
LOG_COUT_LEVEL        WARN
LOG_FILE              $DATADIR/sim-mfsm.log

# number of days to simulate
DAYS                  12

# how many objects to buffer before sending a message
COMM_BUFFER_COUNT      1000

# Always use 1
INIT_VIA_MESSAGES     1

# number of peices the data files are split into.
INIT_NUM_READERS      1

# general random seed.  Use 0 to dynamically create one.
RANDOM_SEED             1235

# Give names to person attributes (initialized to 0)
PERSON_ATTRIBUTE_1   panic
PERSON_ATTRIBUTE_2   isdiagnosed
PERSON_ATTRIBUTE_3   healthseeking

# binary person file header
PERSON_HEADER Id Group HomeLoc FSMState1 FSMState2 DemoClass

# map of types to id ranges
SUBLOCATION_MODEL_FILE $DATADIR/civ_loc_model.txt

set PERSON_FILES base active
{
  FILENAME           $DATADIR/persons.bin
  BINARY 1
}

set LOCATION_FILES base active
{
  FILENAME         $DATADIR/locations.txt
  BINARY 0
}

set SCHEDULE_FILES base active
{
  FILENAME       $DATADIR/visits.txt
  SCHEDULE_TYPE   base
```

```
  BINARY 0
}

set SCHEDULE_FILES stayhome active
{
  FILENAME       $DATADIR/stayhome_visits.txt
  SCHEDULE_TYPE   stayhome
  BINARY 0
}

SCENARIO_FILE         $RUNDIR/example.scn

# collect social network.
SOCIAL_NETWORK_FILE   $DATADIR/socnet.txt
SOCIAL_NETWORK_DAYS   1 2 10

# specify output files
VARIABLE_OUTPUT_FILE  $RUNDIR/vars-mfsm.log
SET_OUTPUT_FILE  $RUNDIR/set-mfsm.log

# define machines
DISEASE_TRANSMISSIBILITY   0.000045
set FSM disease active
{
  FILENAME  $RUNDIR/H5N1.mnf

  # Map of initial state numbers to state names
  FSM_STATE_0                Circulating:uninfected
  FSM_STATE_1                Incapacitated:uninfected

  # Initialize state from person file
  STATE_INITIALIZATION  demographic
  DEMOGRAPHIC_NAME      FSMState1

  # Names of attributes
  ATTRIBUTE_NAME_1      infected
  ATTRIBUTE_NAME_2      symptomatic
  ATTRIBUTE_NAME_3      incapacitation

  # names of transitions
  TRANSITION_TYPE_0     Untreated
  TRANSITION_TYPE_1     antiviral
  TRANSITION_TYPE_2     vaccine
}

set FSM trace active
{
  FILENAME  $RUNDIR/trace_test.mnf
  FSM_STATE_1                traceable:not_tracing
  FSM_STATE_2                untraceable:not_tracing

  STATE_INITIALIZATION  constant
```

```
  CONSTANT_VALUE        1

  ATTRIBUTE_NAME_1      attribute1
  ATTRIBUTE_NAME_2      attribute2
  ATTRIBUTE_NAME_3      attribute3

  TRANSITION_TYPE_0           no_trace
}


# collect disease and dendogram data
set FILTER_OUTPUT Disease active
{
  FILTER_OUTPUT_OBJECT   Disease
  FILTER_OUTPUT_FILENAME $DATADIR/disease.txt
  FILTER_OUTPUT_DISPLAY  ALL
  FILTER_CLAUSE_1        state < 41
}

set FILTER_OUTPUT Disease active
{
  FILTER_OUTPUT_OBJECT   Disease
  FILTER_OUTPUT_FILENAME $DATADIR/trace.txt
  FILTER_OUTPUT_DISPLAY  ALL
  FILTER_CLAUSE_1        state >= 41
}

set FILTER_OUTPUT Dendogram active
{
  FILTER_OUTPUT_OBJECT   Dendogram
  FILTER_OUTPUT_FILENAME $DATADIR/flu_dendogram.txt
  FILTER_OUTPUT_DISPLAY  ALL
  FILTER_CLAUSE_1        fsm = 0
}

set FILTER_OUTPUT Dendogram active
{
  FILTER_OUTPUT_OBJECT   Dendogram
  FILTER_OUTPUT_FILENAME $DATADIR/contact_dendogram.txt
  FILTER_OUTPUT_DISPLAY  ALL
  FILTER_CLAUSE_1        fsm = 1
}
```

Scenario File Grammar

⟨scenario⟩ → **version** ⟨maojr⟩**.**⟨minor⟩
(⟨intervention⟩ |⟨ trigger⟩ |⟨ comment⟩)*
⟨intervention⟩ → **intervention** ⟨int_name⟩ ⟨action⟩$^+$
⟨trigger⟩ → **trigger** [**repeatable**] [**single**] [**with prob =** ⟨value⟩] ⟨condition⟩ ⟨action⟩
⟨action⟩ →
apply ⟨int_name⟩ [**with prob=** ⟨value⟩] |
treat ⟨treatment_name⟩ |
untreat ⟨treatment_name⟩ |
schedule ⟨sched_name⟩ ⟨priority⟩ |
unschedule ⟨priority⟩ |
infect |
transition ⟨fsm_name⟩ [**:**⟨state_name⟩] [**keeptime** | **normal**] |
remove |
endsim |
message ¨⟨string⟩¨ |
set (⟨var_name⟩ | **person.**⟨person_attribute⟩) (**=** ⟨value⟩ | **++** | **−−** | **+=** ⟨value⟩ | **-=** ⟨value⟩) |
add (⟨var_name⟩ | **person.**⟨person_attribute⟩) **to** ⟨set_name⟩ |
delete (⟨var_name⟩ | **person.**⟨person_attribute⟩) **from** ⟨set_name⟩
⟨condition⟩ → ⟨or_expr⟩
⟨or_expr⟩ → ⟨and_expr⟩ | **or** ⟨and_expr⟩
⟨and_expr⟩ → ⟨not_expt⟩ | **and** ⟨not_expr⟩
⟨not_expt⟩ → **not** ⟨or_expr⟩ | **(** ⟨or_expr⟩ **)** | ⟨base_expr⟩
⟨base_expr⟩ → ⟨binary_cond⟩ |⟨ set_cond⟩
⟨binary_cond⟩ → ⟨var_name⟩ ⟨binary_op⟩ ⟨value⟩
⟨set_cond⟩ → ⟨set_name⟩ **intersect** ⟨set_name⟩ **is not null** |
⟨set_name⟩ **contains** (⟨var_name⟩ | **person.**⟨person_attribute⟩)
⟨binary_op⟩ → < | <**=** | **=** | **!=** | >**=** | >
⟨name⟩ → **[a-zA-Z0-9_:]**$^+$
⟨var_name⟩ →
day |
time |
person.id |
person.infected |
person.removed |
person.⟨person_attribute⟩ |
⟨fsm_name⟩**.infectivity** |
⟨fsm_name⟩**.susceptibility** |
⟨fsm_name⟩**.state** |
⟨fsm_name⟩**.**⟨fsm_attribute⟩
person.traced |
person.tracedby |

Example Scenario File

```
# initially infect 4 people per million
intervention infect
  infect
  set num_infected++
trigger day > 0
  apply infect with prob = 0.000004

# age dependant vaccination
intervention vaccinate
  set total_vac++
  treat vaccine
intervention vaccinate_senior
  set senior_vac++
  apply vaccinate
intervention vaccinate_adult
  set adult_vac++
  apply vaccinate
intervention vaccinate_child
  set child_vac++
  apply vaccinate
trigger person.age >= 65
  apply vaccinate_senior with prob = 0.75
trigger person.age >= 18 and person.age < 65
  apply vaccinate_adult with prob = 0.5
trigger person.age < 18
  apply vaccinate_child with prob = 1.0

 # count current infections - method 1
intervention remove
  remove
  set current_infected--
trigger disease.state = disease:Incapacitated:removed
  apply remove
trigger infected = 1
  set current_infected++

 # count current infections - method 2
intervention become_infected
   set person.amInfected = 1
   set current_infected++
intervention no_longer_infected
   set person.amInfected = 0
   set current_infected--
trigger infected = 1 and person.am_infected = 0
  apply become_infected
trigger infected = 0 and person.am_infected = 1
  apply no_longer_infected
```

```
# symptom dependant selfisolation
intervention selfisolate
  schedule isolate 2
trigger with prob = 0.05 repeatable time = 0 and disease.symptom = 1
      and panic.level > 2 and person.incapacitation = 2
  apply selfisolate
trigger with prob = 0.10 repeatable time = 0 and disease.symptom = 2
      and panic.level > 2 and person.incapacitation = 2
  apply selfisolate
trigger with prob = 0.25 repeatable time = 0 and disease.symptom = 3
      and panic.level > 2 and person.incapacitation = 2
  apply selfisolate

# count number of days with more than 1000 people infected
trigger single repeatable current_infected > 1000
        set epidemic_days++
trigger single repeatable current_infected < 500
        set epidemic_days=0
```

Example Data Files

Person File

```
#Id Group HomeLoc FSMState1 FSMState2
1 200007 23 1 1
2 200009 29 1 1
3 200010 84 1 1
4 200010 84 1 1
5 200015 15 1 1
6 200020 58 1 1
7 200029 19 1 1
8 200029 19 1 1
9 200029 19 1 1
```

Location File

```
#Id RT_home RT_work RT_shop RT_other RT_school RT_college
1 1 1 1 4 59 0
2 1 0 1 4 38 1
3 1 1 1 4 40 1
4 0 1 1 4 46 1
5 1 1 1 4 37 1
6 1 0 1 4 38 0
7 1 1 1 4 38 1
8 0 1 1 4 29 1
9 0 1 1 4 27 0
```

Visit File

```
#Person location Sublocation StartTime EndTime Type
1    23 1000     0 42480 0
1 52033 2000 42480  9720 1
1 13164 2000 53100 15300 1
1   616   -4 71100 10800 4
1    23   -4 84600 45000 5
2    29 1000     0 36000 0
2    40   -3 36600  7200 2
2 10905   -3 44100  4079 2
2    29   -4 49500 80100 4
```

Sublocation Model File

```
room_type start_id db_column
1 1000 RT_home
2 2000 RT_work
3 3000 RT_shop
4 4000 RT_other
5 5000 RT_school
6 6000 RT_college
```

Example Output Files

State Progression File

```
#person time state
#  3 disease:Incapacitated:latent_long
#  2 disease:Incapacitated:latent_short
# 16 disease:Incapacitated:removed
#  1 disease:Incapacitated:saved_by_Rx
632      0  2
632  80266 15
728      0  2
728  80387 15
891      0  2
891  82267 15
632 167503 13
632 621696 16
```

Dendogram File

```
#person homeloc time fsm infectedBy actloc actsubloc acttype rooomtype
632   2     0          0     -1    -1    -1    -1    -1
728   82    0          0     -1    -1    -1    -1    -1
4353  67    96179      0     4355  67    1018  0     1
4098  9     182351     0     4095  9     1015  0     1
3140  43    273343     0     3141  43    1012  0     1
4779  42    289184     0     891   21677 2000  1     2
893   69    452804     0     891   69    1002  0     1
4096  9     539874     0     4095  9     1015  0     1
4097  9     615166     0     4098  9     1015  0     1
729   82    711442     0     728   82    1000  0     1
```

Social Network File

```
#id acttype id acttype duration
4  0  3 0 40199
8  0  7 0 35999
9  0  7 0 34199
9  0  8 0 34199
12 0 11 0 30898
13 0 11 0 30898
13 0 12 0 30898
14 0 11 0 30898
14 0 12 0 30898
```

Scenario Variable File

```
#day inset notinset null num_infected people tnt
1  0 7855 0 14 0 7855
2  0 7855 0 14 0 7855
3  0 7855 0 14 0 7855
4  0 7855 0 14 0 7855
5  0 7855 0 14 0 7855
6  0 7855 0 14 0 7855
7  0 7855 0 14 0 7855
8  0 7855 0 14 0 7855
9  0 7855 0 14 0 7855
10 0 7855 0 14 0 7855
```