CS-SDP 262 Computational Social Science Final Project 2021:
'A Simple Permit System Model'

Instructor: Dr. Shah Jamal Alam
Group members: Abeer Khan, Faiz Haseeb, Amal Iqbal, Aneeq Akhtar, Asim Ali Khan

I. **Model Title: 'A Simple Permit System Model'**

II. **Storyline:**

The partition of India in 1947 resulted in the division of the subcontinent, forcing many Muslims to leave behind their belongings and loved ones. Pakistan, as a young country, faced numerous challenges in rehabilitating the massive stream of Muslim refugees that it was receiving. Many Muslims in Pakistan thought they had made a big mistake as a result of this. As a result, numerous Muslim refugees returned to India, either temporarily or permanently, to rejoin with their goods and family. India implemented a permit system on July 19, 1948, to manage outflows and inflows and establish who was an Indian and who was a foreigner. Pakistan followed suit and introduced a similar scheme not long after. There were several types of permissions issued, including temporary and permanent permits.

Muslims often applied for both temporary and permanent permits, and if they did not get the former, would simply discard their temporary permit and settle back into India, or would apply for a permanent permit once arriving in India. On the temporary permit form, many people would state that the objective of their visit was to return home, demonstrating how divided the partition was. Many Muslims, however, would be persecuted for overstaying past their permit's expiry date and would face criminalization, fines, deportation, or imprisonment. This was due to the realization by the Indian government, that many permit holders overstayed their welcome in India, and as a result, regulations were enacted making overstaying a temporary permit a criminal violation. The permission system was in place until October 15, 1952, when The India–Pakistan Passport and Visa Scheme took over.

III. **Purpose:** This model is designed to simulate the migration patterns of muslims/muhajirs that occurred during this era. How does variation in india-violence, pakistan-violence, permanent-permit-chance, and temporary-permanent-chance affect the relocation patterns and citizenship status of Muslims of India and Pakistan?

IV. **Agents/Entities:**

There is a single kind of entity: agents which represent the Muslims of the subcontinent. They are characterized by the following attributes:

a) Agents are created as turtles in NetLogo.

b) religion: At the time an agent is created, they are assigned the "muslim" religion status which remains unchanged throughout the course of the simulation.

c) citizenship: At the time an agent is created, it could be assigned the "india" citizenship status if it is present on the left side of the environment (which represents india), or it could be assigned the "pakistan" citizenship status if it lies on the right side of the environment (which represents pakistan). At any time, an agent's citizenship status can be either "india" or "pakistan".

d) ***want-to-move:*** At the time an agent is created, it could be assigned either “yes” or “no” on a random basis. During the course of the simulation, the agents can be assigned either “yes”, “no”, or “moved”. An agent’s want-to-move status will only be assigned as “moved” if it has been able to permanently relocate.

e) ***rehabilitated:*** At the time an agent is created, it could be assigned either “yes” or “no” on a random basis.

f) ***has-permit:*** At the time an agent is created, it is assigned “no” by default as it does not have a permit. During the course of the simulation, this status can be changed to “yes” if an agent is able to acquire a permanent or temporary permit. This status can be changed to a “no” if an agent’s temporary permit is no longer valid.

g) ***type-permit:*** At the time an agent is created, it is assigned a value of 0. During the course of the simulation, this status can be changed to “temporary” if an agent acquires a temporary permit, or to “permanent” if an agent acquires a permanent permit, or to “none” when an agent’s temporary permit is no longer valid.

h) ***time-permit:*** This represents the amount of time a permit is valid for. At the time an agent is created it is assigned a value of 0. During the course of the simulation, this status could be changed to either a 0, 4, 8, or 12.

i) ***violence:*** At the time an agent is created, it is randomly assigned a value out of 100. During the course of the simulation, this value can be changed to another random integer out of 100 when an agent acquires a permit and moves.

j) ***date:*** This represents the tick at which an agent was able to acquire a permit. At the time an agent is created, it is assigned a value of 0. During the course of the simulation, this value can change depending on when an agent acquires a permit.

k) ***number-permit:*** This represents the total amount of permits an agent has had. At the time an agent is created, it is assigned a value of 0 (an agent does not hold any permits at the time of creation). During the course of the simulation, this value can change depending on how many permits an agent is able to get.

V. Time: A tick (time stamp) in this model corresponds to one week in the life of agents. This model attempts to simulate the migration patterns that occurred from 19th July 1948 to 15th October 1952. In order to keep the simulation running for a good amount of time, we decided to consider each time stamp to correspond to a week, instead of a month. This results in the simulation running for about 200 ticks.

VI. Process Overview and Scheduling:

A. ask-pakistan: This process checks if any agent in “pakistan" (xcor > 0) wants to apply for a permit. Since an agent’s decisions can be influenced by others, we make an assumption that an agent should know more than 2 agents who want to move to India in order to be influenced to move. An agent will only want to acquire a permit to move if:

a) The agent does not have a permit.
b) The agent is not rehabilitated.
c) The agent is experiencing an amount of violence that is greater than the average percent of violence being experienced in India.
d) The agent has more number of family members, friends, co-workers in India than in Pakistan.
e) The agent knows that more than 2 agents want to move to India.

If any or all of these conditions are satisfied, then the agent can try to acquire a permit using ***get-permit***. If it is able to acquire a permanent permit:

a) p_permit_counter_karachi is incremented by one.
b) The agent moves to India.
c) The agent’s citizenship status is changed to “india”.
d) The agent’s date value is changed to the counter value.
e) The agent’s number_permit counter is incremented by one.

If the agent is able to acquire a temporary permit:

a) t_permit_counter_karachi is incremented by one.
b) The agent moves to India.
c) The agent’s date value is changed to the counter value.
d) The agent’s number_permit counter is incremented by one.

B. ask-india: This process checks if any agent in “india” (xcor < 0) wants to apply for a permit. Since an agent’s decisions can be influenced by others, we make an assumption that an agent should know more than 2 agents who want to move to Pakistan in order to be influenced to move. An agent will only want to acquire a permit to move if:

a) The agent does not have a permit.
b) The agent is not rehabilitated.
c) The agent is experiencing an amount of violence that is greater than the average percent of violence being experienced in Pakistan.

d) The agent has more number of family members, friends, co-workers in Pakistan than in India.
e) The agent knows that more than 2 agents want to move to Pakistan.

If any or all of these conditions are satisfied, then the agent can try to acquire a permit using a ***get-permit***. If it is able to acquire a permanent permit:

a) p_permit_counter_india is incremented by one.
b) The agent moves to Pakistan.
c) The agent's citizenship status is changed to "Pakistan".
d) The agent's date value is changed to the counter value.
e) The agent's number_permit counter is incremented by one.

If the agent is able to acquire a temporary permit:

a) t_permit_counter_india is incremented by one.
b) The agent moves to Pakistan.
c) The agent's date value is changed to the counter value.
d) The agent's number_permit counter is incremented by one.

C. get-permit: This process helps an agent acquire a temporary or permanent permit. A local variable "permit" is assigned a random integer out of 100. We make an assumption, that if an agent wants to permanently relocate, it would try to acquire a permanent permit first. If it is unable to acquire a permanent permit, then only it would try to acquire a temporary permit. We make another assumption, that a temporary permit can only be valid for up to 3 months. We make another assumption, that an agent would not experience the same amount of violence it was experiencing in its homeland. Thus, we create another local variable "v" which is assigned a random integer out of 100.

If an agent is able to acquire a permanent permit:
a) Assign the agent's has-permit status as "yes".
b) Assign the agent's type-permit as "permanent".
c) Change the agent's violence value to "v".
d) Assign the agent's want-to-move status as "moved".

If an agent is able to acquire a temporary permit:
a) Assign the agent's has-permit as "yes".
b) Assign the agent's type-permit as "temporary".
c) Assign the time-permit a value. The value could be 4, 8, or 12 and it is randomly assigned.
d) Change the agent's violence to "v".

D. ***check-migrate:*** This process checks if an agent has a temporary permit that is no longer valid. Depending on the agent's citizenship, the following process will be called:

   a) ***migrate-india:*** If a Pakistani agent was unable to acquire a permanent permit and received a temporary permit, instead, then there are two possibilities:

1. The agent is able to convert the temporary permit into a permanent permit when it is no longer valid. The following happens:

   a) The agent's citizenship status is changed to "india".
   b) The agent's type-permit status is changed to "permanent".
   c) The agent's want-to-move status is changed to "moved".
   d) The agent's time-permit value is set to 0.

2. The agent is not able to convert the temporary into a permanent permit and must return back to its country. The following happens:

   a) The agent will move back to Pakistan.
   b) The agent's has-permit status will be changed to "no".
   c) The agent's type-permit status will be changed to "none".
   d) The agent's time-permit value will be set to 0.

A local variable called "m" is created which is assigned a value of 0 or 1 at a time randomly. If the value of m is 0, then the temporary permit cannot be converted into a permanent permit. If the value of m is 1, then the temporary permit can be converted into a permanent permit.

b) migrate-pakistan: If an Indian agent was unable to acquire a permanent permit and received a temporary permit, instead, then there are two possibilities:

1. The agent is able to convert the temporary permit into a permanent permit when it is no longer valid. The following happens:

   a) The agent's citizenship status is changed to "Pakistan".
   b) The agent's type-permit status is changed to "permanent".
   c) The agent's want-to-move status is changed to "moved".
   d) The agent's time-permit value is set to 0.

2. The agent is not able to convert the temporary into a permanent permit and must return back to its country. The following happens:

   a) The agent will move back to India.

b) The agent's has-permit status will be changed to "no".
c) The agent's type-permit status will be changed to "none".
d) The agent's time-permit value will be set to 0.

A local variable called "m" is created which is assigned a value of 0 or 1 at a time randomly. If the value of m is 0, then the temporary permit cannot be converted into a permanent permit. If the value of m is 1, then the temporary permit can be converted into a permanent permit.

E. get-temp-permit:

This process helps an agent acquire a temporary permit. A local variable "permit" is assigned a random integer out of 100. We make an assumption that a temporary permit can only be valid for up to 3 months. We make another assumption, that an agent would not experience the same amount of violence it was experiencing in its homeland. Thus, we create another local variable "v" which is assigned a random integer out of 100.

If an agent is able to acquire a temporary permit:

a) Assign the agent's has-permit as "yes".
b) Assign the agent's type-permit as "temporary".
c) Assign the time-permit a value. The value could be 4, 8, or 12 and it is randomly assigned.
d) Change the agent's violence to "v".

F. temporary-permit: In this process, agents can only receive temporary permits for relocation.

a) This process checks if any agent in "pakistan" (xcor > 0) wants to apply for a permit. Since an agent's decisions can be influenced by others, we make an assumption that an agent should know more than 2 agents who want to move to India in order to be influenced to move. An agent will only want to acquire a permit to move if:

    a) The agent does not have a permit.
    b) The agent is not rehabilitated.
    c) The agent is experiencing an amount of violence that is greater than the average percent of violence being experienced in India.
    d) The agent has more number of family members, friends, co-workers in India than in Pakistan.
    e) The agent knows that more than 2 agents want to move to India.

    If any or all of these conditions are satisfied, then the agent can try to acquire a temporary permit using ***get-temp-permit***. If it is able to acquire a temporary permit:

a) t_permit_counter_karachi is incremented by one.
b) The agent moves to India.
c) The agent's date value is changed to the counter value.
d) The agent's number_permit counter is incremented by one.

b) This process checks if any agent in "india" (xcor < 0) wants to apply for a permit. Since an agent's decisions can be influenced by others, we make an assumption that an agent should know more than 2 agents who want to move to Pakistan in order to be influenced to move. An agent will only want to acquire a permit to move if:

a) The agent does not have a permit.
b) The agent is not rehabilitated.
c) The agent is experiencing an amount of violence that is greater than the average percent of violence being experienced in Pakistan.
d) The agent has more number of family members, friends, co-workers in Pakistan than in India.
e) The agent knows that more than 2 agents want to move to Pakistan.

If any or all of these conditions are satisfied, then the agent can try to acquire a permit using ***get-temp-permit***. If it is able to acquire a temporary permit:

a) t_permit_counter_india is incremented by one.
b) The agent moves to Pakistan.
c) The agent's date value is changed to the counter value.
d) The agent's number_permit counter is incremented by one.

c) ***check-migrate***
   a) migrate-pakistan
   b) migrate-india

G. get-perm-permit:

This process helps an agent acquire a permanent permit. A local variable "permit" is assigned a random integer out of 100. We make an assumption, that an agent would not experience the same amount of violence it was experiencing in its homeland. Thus, we create another local variable "v" which is assigned a random integer out of 100.

If an agent is able to acquire a permanent permit:

a) Assign the agent's has-permit status as "yes".
b) Assign the agent's type-permit as "permanent".
c) Change the agent's violence value to "v".

d) Assign the agent's want-to-move status as "moved".

H. permanent-permit: In this process, agents can only receive permanent permits for relocation.

a) This process checks if any agent in "pakistan" (xcor > 0) wants to apply for a permit. Since an agent's decisions can be influenced by others, we make an assumption that an agent should know more than 2 agents who want to move to India in order to be influenced to move. An agent will only want to acquire a permit to move if:

f) The agent does not have a permit.
g) The agent is not rehabilitated.
h) The agent is experiencing an amount of violence that is greater than the average percent of violence being experienced in India.
i) The agent has more number of family members, friends, co-workers in India than in Pakistan.
j) The agent knows that more than 2 agents want to move to India.

If any or all of these conditions are satisfied, then the agent can try to acquire a permit using ***get-perm-permit***. If it is able to acquire a permanent permit:

a) p_permit_counter_karachi is incremented by one.
b) The agent moves to India.
c) The agent's citizenship status is changed to "India".
d) The agent's date value is changed to the counter value.
e) The agent's number_permit counter is incremented by one.

b) This process checks if any agent in "india" (xcor < 0) wants to apply for a permit. Since an agent's decisions can be influenced by others, we make an assumption that an agent should know more than 2 agents who want to move to Pakistan in order to be influenced to move. An agent will only want to acquire a permit to move if:

f) The agent does not have a permit.
g) The agent is not rehabilitated.
h) The agent is experiencing an amount of violence that is greater than the average percent of violence being experienced in Pakistan.
i) The agent has more number of family members, friends, co-workers in Pakistan than in India.
j) The agent knows that more than 2 agents want to move to Pakistan.

If any or all of these conditions are satisfied, then the agent can try to acquire a permit using ***get-perm-permit***. If it is able to acquire a permanent permit:

a) p_permit_counter_india is incremented by one.
b) The agent moves to Pakistan.
c) The agent's citizenship status is changed to "Pakistan".
d) The agent's date value is changed to the counter value.
e) The agent's number_permit counter is incremented by one.

c) ***check-migrate***
c) migrate-pakistan
d) migrate-india

VII. Stochasticity:

a) Assignment of agent location at the time of creating a new agent.
b) Assignment of an agent's want-to-move status at the time of creating a new agent.
c) Assignment of an agent's rehabilitation status at the time of creating a new agent
d) Assignment of an agent's violence value at the time of creating a new agent.
e) Agents create random links with other agents
f) Whether a temporary permit can turn into a permanent permit or not.
g) Assignment of an agent's time-permit value when an agent acquires a temporary permit.
h) Change in agent's violence value when an agent moves/relocates.

VIII. Sensing: Every agent will be aware of the violence it is facing in the area it is located and the connections it has with other agents.

IX. Interactions: Agents' relocation decisions will depend on different factors including a comparison between violence they face in the two countries, the number of connections (links) they have with other agents located in either India (orange) or Pakistan (green), the number of connections (links) they have with other agents who want to relocate, and if they have a permit or not.

X. Model Initialization and Setup:

a) There is a spatial representation of the environment.
b) The environment is implemented on an unwrapped 2D grid, with min-pxcor and max-pxcor being set to 16.
c) The patch size is set to 13.
d) The environment is divided into two parts with a central vertical white dividing line marking the partition.
e) The patches on the left side of the environment (with pxcor < 0) are colored as "orange" and this region represents India.

f) The patches on the right side of the environment (with pxcor > 0) are colored “green” and this region represents Pakistan.
g) Agents are then created and randomly placed in both regions of the environment and assigned a citizenship status based on what region they’re in.
h) Set agents’ shape "person".
i) Set agents’ color “black”.

After the agents are created, a random network is created in which each agent can create links with other agents. The probability of each agent being able to establish a link with other agents varies. The links are hidden.

The model has several global parameters that are outlined as below:

a) muslims-pakistan: Represents the number of pakistani agents in the model (default: 50, min: 1, max: 100).

b) muslims-india: Represents the number of indian agents in the model (default: 50, min: 1, max: 100).

c) india-violence: Represents the average percentage amount of violence occurring in India (default: 92, min: 1, max: 100).

d) pakistan-violence: Represents the average percentage amount of violence occurring in Pakistan (default: 12, min: 1, max: 100).

e) permanent-permit-chance: Represents the probability of acquiring a permanent permit (default: 30, min: 1, max: 100).

f) temporary-permit-chance: Represents the probability of acquiring a temporary permit (default: 50, min: 1, max: 100).

g) counter: This represents the total number of ticks that have passed and is incremented with each tick. When an agent has acquired a permit, we assign the counter value to date, which is then used to help us find out when a temporary permit is no longer valid.

h) p_permit_counter_karachi: This represents the number of permanent permits that are being issued in Karachi. When an agent with “pakistan” as it’s citizenship status acquires a permanent permit, this counter is incremented by one. At the start of the simulation and when the simulation has finished running, this counter is set to 0.

i) p_permit_counter_india: This represents the number of permanent permits that are being issued in India. When an agent with “india” as it’s citizenship status acquires a permanent permit, this counter is incremented by one. At the start of

the simulation and when the simulation has finished running, this counter is set to 0.

j) ***t_permit_counter_karachi:*** This represents the number of temporary permits that are being issued in Karachi. When an agent with “pakistan” as it’s citizenship status acquires a temporary permit, this counter is incremented by one. At the start of the simulation and when the simulation has finished running, this counter is set to 0.

k) ***t_permit_counter_india:*** This represents the number of temporary permits that are being issued in India. When an agent with “india” as its citizenship status acquires a temporary permit, this counter is incremented by one. At the start of the simulation and when the simulation has finished running, this counter is set to 0.

XI. **Input Data:** The model has no input data.

XII. **Outputs:** The following screenshot of the implementation in NetLogo shows one type of output. The four monitors display the varying number of permits that are issued in Karachi and Delhi.

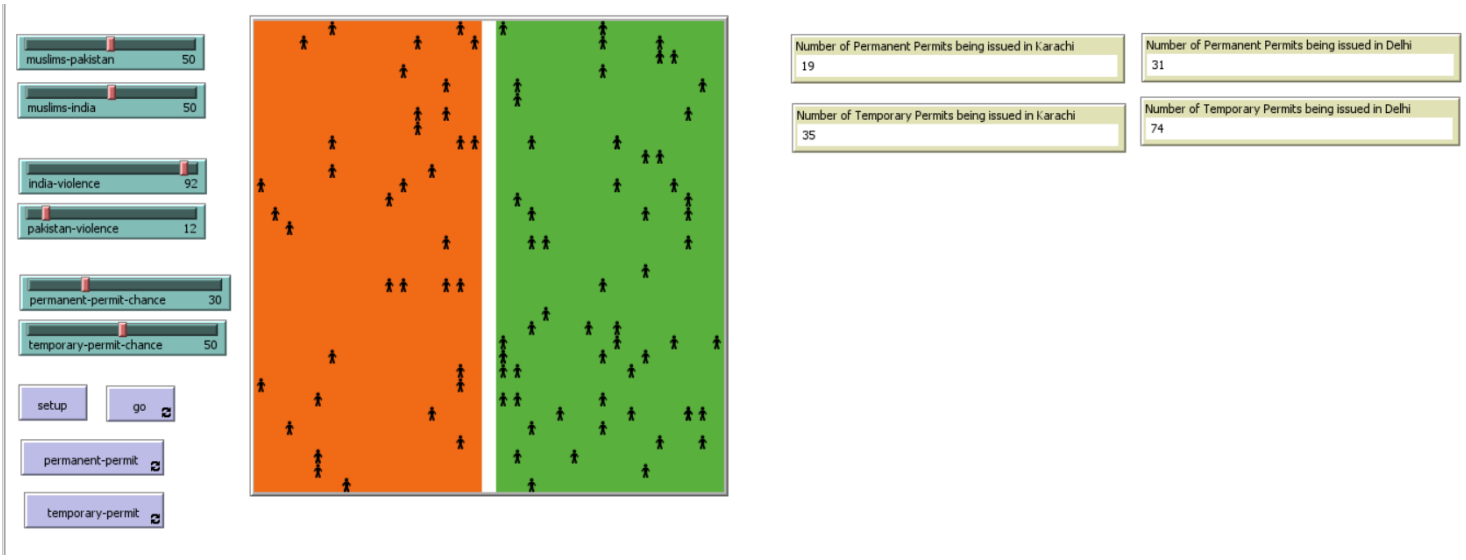
XIII. **Submodels/Functions:**

There are three ways to simulate this model:

a) In the go function, agents are able to acquire either a temporary permit or a permanent permit. This function runs for 200 ticks. Processes used in the go function: ***ask-pakistan, ask-india, get-permit, check-migrate, migrate-pakistan, migrate-india.***

b) In the temporary permit function, agents are able to acquire only a temporary permit for relocation. This function runs for 200 ticks. Processes used in this function: ***temporary-permit, get-temp-permit, check-migrate, migrate-pakistan, migrate-india.***

c) In the permanent permit function, agents are able to acquire only a permanent permit for relocation. This function runs for 200 ticks. Processes used in this function: ***permanent-permit, get-perm-permit, check-migrate, migrate-pakistan, migrate-india.***



References

Zamindar, Vazira. *The Long Partition and the Making of Modern South Asia*. Columbia University Press, 2010.