

**Project #3**  
**POSIX threads under Unix/Linux**  
**Due: January 10, 2025**

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## Counter espionage agency simulation

Counter espionage agency is the agency responsible to fight spying activities done by an enemy. We'll assume resistance groups have created a counter espionage agency to protect resistance members from being caught, injured or killed. Since such a simulation can be too difficult, we'll make the following simplifying assumptions:

- We'll disregard spying activities of the enemy that involves use of technology (mobile phone tracking, image recognition, satellite GPS, etc). As such we'll consider only the damage inflicted by infiltrated spies that share with the enemy information about the resistance groups plans and the geographical location of resistance members.
- We'll assume counter espionage agency members are totally unknown to resistance groups for security reasons.
- We'll assume as well that counter espionage members are always clean, meaning there is no infiltration by the enemy within the agency.

The counter espionage agency simulation can be described as follows:

- Assume the counter espionage agency is composed of user-defined number of members. New members are added to the agency *only* when current members die, get killed or caught by the enemy.
- Assume resistance groups are created every user-defined amount of time. Each group might be composed of a random number of members that is bound by a user-defined interval. Resistance groups might be of social type (do social activities such as humanitarian aid) or military type (carry out military attacks on the enemy). The resistance groups involved in military activities are more subject to being spied on and get targeted by the enemy later on (user-defined).
- Resistance groups might be infiltrated by spies. These spy-members are of course either never targeted by the enemy, or targeted but never sustain serious injuries (to make them look less suspicious). Assume each resistance group can be infiltrated by 1 spy max.
- Resistance groups can be spied upon by regular people as well. By regular people we mean civilians in general. We'll assume the more time someone spends in touch with a resistance group the more likely they get to know sensitive information about its activities.
- Resistance groups share information with the counter espionage agency members about people they meet and the time they spend with them. That information is used by the agency members later on for analysis.
- When targeted by the enemy, members of resistance groups can either be all killed, or some killed and some injured and some caught.

If killed or got caught, a resistance member exits the simulation.

If got injured, joining the group again depends on the injury: If the injury is severe, the resistance member exits the simulation. If the injury is light, he/she re-joins after a user-defined recovery period that depends on the injury level (user-defined). In addition, new resistance members can join a group as a replacement to the killed or injured members.

- The more time a spy spends with a resistance group, the more it is likely that the resistance groups will be targeted by the enemy.
- As mentioned above, the counter espionage agency analyzes the data it collects from the resistance groups regularly to draw conclusions about potential infiltrated spies. The conclusions are drawn as well when events happen (e.g. a resistance group has been targeted).

Potential spies are arrested by the agency for questioning when the suspicion rate increases beyond a user-defined threshold. After questioning, potential spies are either released or imprisoned based on a user-defined threshold.

Assume that arrested potential spies exit the simulation once their spying activities are confirmed.

- Counter espionage agency members might get killed, injured or caught by the enemy just like any resistance member. When that happens, a new trustworthy member joins the agency. Assume the more time a counter espionage agency member stays with the agency, the more likely he/she will be targeted by the enemy. Make that time user-defined.

The counter espionage agency simulation ends if any of the following is true:

- The number of killed resistance members exceeds a user-defined threshold.
- The number of injured resistance members exceeds a user-defined threshold.
- All the counter espionage agency members have been killed or caught within a user-defined amount of time.

## What you should do

- Implement the above-described problem on your Linux machines using a combined multi-processing and multi-threading approach for implementing the counter espionage agency simulation. The civilians, resistance groups, counter espionage agency are processes. However, resistance group members and counter espionage agency members are threads.
- Compile and test your program.
- Check that your program is bug-free. Use the `gdb` debugger in case you are having problems during writing the code (and most probably you will :-). In such a case, compile your code using the `-g` option of the `gcc`.
- In order to avoid hard-coding user-defined values in your programs, think of creating a text file that contains all the values that should be user-defined and give the file name as an argument to the main program. That will spare you from having to change your code permanently and re-compile.
- Use graphics elements from opengl library in order to best illustrate the application. Nothing fancy, just simple and elegant elements are enough.
- Be realistic in the choices that you make!
- Send the zipped folder that contains your source code and your executable before the deadline. If the deadline is reached and you are still having problems with your code, just send it as is!