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Mars invasion

The martians have decided to invade our planet earth to steal our resources. Our duty is to defend our mother planet from these brutal invaders. We would like to simulate such an event in order to be ready when the due time arrives.

The martian army is composed of (1) army generals, (2) field operation commanders & (3) soldiers. On the opposite side, the human army is flat and is only composed of freedom fighters without any hierarchy.

The simulation should consider the following:

- The martian army generals are 6-eyed: 2 are located on the front-face, 2 on the back-head, 1 to the left side and 1 to the right side. These eyes emit laser beams to neutralize the human freedom fighters anywhere they are within the range $[0 \dots 100]$ meters. After 100 meters, the laser beam has no effect.

Usually the martian army doesn't have too many generals but their percentage should be user-defined.

- The martian army field operation commanders are 4-eyed: 2 are located in the front-face and 2 in the back-head. They cannot shoot human freedom fighters located on the left or right sides without turning their heads. The laser beam is harmful to humans within the range $[0 \dots 100]$ meters.

In general, the percentage of field operation commanders is higher than army generals but their percentage should be user-defined.

- The martian army soldiers have each 2 laser-emitting eyes in the front-face. Just as humans, they can only see and shoot laser beams in the direction they are looking at. They need to turn their heads to locate and shoot at the enemy if located to the left side, right side or behind. As mentioned above, the laser is harmful to humans in the range $[0 \dots 100]$ meters.

The percentage of martian army soldiers should be the highest.

To eliminate the martians, human freedom fighters need to do one of the following:

- 10 shots in the head within the range $[0 \dots 75]$ meters, or
- 1 shot in each laser emitting eye until they are blind. When they become blind, martians die. Bullets are effective only within the range $[0 \dots 75]$ meters.

To eliminate human fighters, martians need to do one of the following:

- 2 shots by laser beam in the head or the chest, or
- 4 shots by laser beam in the abdomen or the back, or
- 6 shots by laser beam in the legs and feet.

The rules of engagement for the 2 armies are as follows:

- A martian invader can shoot a laser beam at only 1 human fighter at a time within the range described above ($[0 \dots 100]$ meters). The selection criteria is to pick the human fighter that is closest to it (*in any direction*). Thus, a martian invader might need to turn its head if needed to locate human enemies to its right, left or even behind (in that exact order). Once it picks the closest enemy fighter, it shoots the laser beam if within the required range. Otherwise, the martian invader will need to walk towards the human fighter to decrease the distance and thus have the target within the range and then fire the laser beam at the right time. Firing on any part of the human body should be random.

Afterwards, the martian invader has to wait for a user-defined amount of time before being able to shoot again. During that time, the martian will try its best to move away from any human fighter fire range to avoid being harmed. If it is far away enough, it sleeps for a user-defined period of time before shooting again.

- Likewise, a human freedom fighter can shoot at 1 martian invader at a time if it is within its range ($[0 \dots 75]$ meters). The selection criteria is the same as for martians: pick the closest (*in any direction*). Thus, a human fighter might need to turn his/her head if needed to locate martian invaders on the right side, left side or even behind (in that exact order). Once it picks the closest martian, the human fighter shoots if within the required range. Otherwise, the human fighter might need to walk to the closest martian invader to have it within the right range. Firing on the martian head or eye should be random. However, do not fire again on martian damaged eyes from previous firings.

Afterwards, the human fighter has to wait for a user-defined period of time before being able to shoot again. During that time, the human fighter will try his/her best to move away from any martian invader fire range to avoid being harmed. If it is far away enough, it sleeps for a user-defined period of time before shooting again.

- During the battle, the martians and human fighters' energy level drops with time. As a result, their shooting capabilities drop (the number of missing-the-target increases) and the speed of running away from the enemy after shooting decreases.
- The simulation should end if any of the following is true:
 - A user-defined number of martian generals were neutralized by human freedom fighters.
 - A user-defined number of martian field operation commanders were neutralized by human freedom fighters.
 - A user-defined number of martian soldiers were neutralized by human freedom fighters.
 - A user-defined number of human freedom fighters were neutralized by martian invaders. Thus we lost the war and will be enslaved by martians. Do your best not to get there :-)

What you should do

- Create a folder called `midterm`
- Under the folder `midterm`, create a file called `midterm.txt`. In that file, describe shortly your vision of how you would implement the above-described problem and the data structure(s) you intend to employ. Discuss as well the communication techniques you would employ to make the implementation happen. Keep it short ... 15 - 20 lines max.
- In order to avoid hard-coding values in your simulation, create a file named `arguments.txt` that should contain all the user-defined values. Fill that file with all user-defined values to make the simulation highly configurable.
- From the above-described problem, implement the behavior of human fighters *only* on your Linux machines using either a multi-processing approach or a multi-threading approach.
- 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`.
- Send the zipped folder that contains your source code, your executable and any additional file you might have created as a reply to my ritaj memo entitled **encs4330 midterm exam - November 24, 2021**.