Back to College

Risubrik is a fellow student of a IIIT-H and he is completely tired of the online
semester and wants to head back to college as soon as possible. He wants to suggest
the college to get all the students vaccinated using his huge internship money along
with a foolproof plan to do so. Help him devise a plan that he can impress the college
with.

Run the code

- **Compilation**

```
$ gcc q2.c -lpthread
```

- **Execution**

```
$ ./a.out
```

Input

First line will have 'n' pharmaceutical companies, 'm' vaccination zones, 'o'
students (note: 0 <=n,m,o)
Second Line will have 'n' probabilities of the success rate of each vaccine
from the n pharmaceutical companies.

Explaination of the code

Variables and arrays

n-number of companies
m-number of zones
o-number of students
v_a[1007]-number of vaccines available in vaccination zone
d_c[1007]-company id whose batch is recieved by zone
slots[1007]-total number of slots available in vaccination zone
filled[1007]-total number of slots filled in vaccination zone
batches[1007]-total number of batches produced by a company
signal_company[1007]-signal company when all batches are finished
val-counter storing the number of students done
x[1007]-probability of each company

Mutex

produce[1007]-lock for company to wait untill all bactches are used
availability[1007]-lock for zone to wait untill vaccines are available
slot_filled[1007]-lock for zone to wait untill all slots are filled
var-ensure only one company delivers a batch to one zone at a time
var1-ensure only one student fills one slot at a time
var2-ensure the val to be incremented correctly

Structures

```
struct p_company{
    int id;
    double probability;
};


struct v_zone{
    int id;
};


struct iiitian{
    int id;
    int round;
};
```

Basic Logic

A separate thread is created for each company, vaccination zone and student. In
company function a mutex lock is used which gets unlocked only when all the batches of
company are used. The company then starts it's production of k(random integer between
1 and 5) batches. After production, we iterate over all the vaccination zones to check
which vaccination zone has finished its vaccines. Then the compnay delivers vaccine to
the vaccination zone and unlocks the availability lock of the the vaccination zone.
Company waits till all its batches get used up(production lock). The vaccination zone
now enters vaccination phase and creates slots, and waits till all the slots are
filled (slot_filled lock). Once all slots get filled, the slot_filled gets unlocked,
vaccination zone now checks for the number of vaccines available, if they are 0, it
increments the counter of batches finished for a company. Once this counter reaches
the total number of bactches, company resumes its production. For students, they
radomly arrive at the main gate and then iterate over all the vaccination zones to
check for empty slots. Once they find an empty slot they increment the
filled[vaccination_zone_id] to fill the slot. Once all the slots are filled, the
vaccination begins. Then the students get vaccinated and decrement the total number of
vaccines left (v_a[vaccination_zone_id]). The students are then tested for antibodies
(choosing a random float between 0 and 1). If they are tested positive val is
incremented and they exit the function. Else they are sent for another vaccination
round . If they are tested negative for 3 times, val is incremented and they are sent
home. Once all students are done, all the mutexes are unlocked.