

# Interview Homework - Backend



## Graid Technology Inc.

1. Write a program that allows a teacher and students named A, B, C, D, and E to play math questions.
  - a. Run the following steps in a loop.
  - b. Teacher behavior: Ask a math question.
    - i. Warm up for 3 seconds.
    - ii. Ask a math question.
      1. Randomly generate "A c B".
      2. A and B are integers between 0 and 100.
      3. c is a mathematical symbol (+, -, \*, /).
    - iii. Wait for the answer, and say "XXX, you are right!"
  - c. Student behavior:
    - i. Wait for the question.
    - ii. See the question and think (randomly between 1 and 3 seconds).
    - iii. Raise hand and answer the question (only one student can answer) (assuming they are always correct).
    - iv. The other students may feel sad and say "XXX, you win".
  - d. Example output:

Teacher: Guys, are you ready?

# Count 3

Teacher:  $1 + 1 = ?$

# May have a few seconds

Student C:  $1 + 1 = 2!$

Teacher: C, you are right!

Student A: C, you win.  
Student B: C, you win.  
Student D: C, you win.  
Student E: C, you win.

e. Bonus

- i. Students may have wrong answer, the other students can try to raise hand and answer the question.

Teacher: Guys, are you ready?

# Count 3

Teacher:  $1 + 1 = ?$

# May have a few seconds

Student C:  $1 + 1 = 3!$

Teacher: C, you are wrong.

Student A:  $1 + 1 = 4!$

Teacher: A, you are wrong.

Student B:  $1 + 1 = 2!$

Teacher: B, you are right!

Student A: B, you win.

Student C: B, you win.

Student D: C, you win.

Student E: C, you win.

# Or there is no student has right answer.

# (all 5 students have wrong answer).

# Teacher feels sad and say the answer.

Teacher: Boooo~ Answer is 2.

- ii. Teacher writes the question on a board per second (means that teacher would not wait for students answer the question). Every questions is a independent process.

Teacher: Guys, are you ready?

# Count 3

Teacher: Q1:  $1 + 1 = ?$

```

Student C: Q1: 1 + 1 = 2!
Teacher: C, Q1 you are right!
Student A: C, Q1 you win.
# teacher ask 2nd question
Teacher: Q2: 3 + 3 = ?
# students can answer 2nd question
# although teacher doesn't confirm 1st answer yet
Student E: Q2: 3 + 3 = 6!
Student B: C, Q1 you win.
Student A: E, Q2 you win.
Student B: E, Q2 you win.
Student D: C, Q1 you win.
Student D: E, Q2 you win.
Student E: C, Q1 you win.
Student C: E, Q2 you win.

```

2. Write a program that demonstrates quorum election. The program should have a specified number of members in the quorum and start an interactive mode for the quorum election game.

a. Game steps:

- i. Start the quorum with N members.
- ii. Elect one of the members as the quorum leader.
- iii. Each member sends heartbeat signals to each other to ensure they are alive.
- iv. Identify a member that has failed to respond to the heartbeat by voting.
  1. Remove the failed member from the quorum.
  2. If the failed member was the leader, go back to step ii.

b. Each member should have an ID starting from 0, 1, 2, and so on.

c. The command "kill 0" should make member 0 unresponsive to others.

d. There are multiple quorum mechanisms available, and you can design a better one according to your requirements. (Hint: Consensus Algorithm, or Centralization)

e. Example output:

```
# launch binary with specified number of member
./main 3

> Starting quorum with 3 members
> Member 0: Hi
> Member 1: Hi
> Member 2: Hi
> Member 0: I want to be leader
> Member 2: Accept member 0 to be leader
> Member 1: I want to be leader
> Member 1: Accept member 0 to be leader
> Member 0 voted to be leader: (2 > 3/2)

> kill 1
> Member 0: failed heartbeat with Member 1
> Member 2: failed heartbeat with Member 1
> Member 1: kick out of quorum: (2 > current/2)
> kill 2
> Member 0: failed heartbeat with Member 1
> Member 0: no response from other users(timeout)
> Member 2: kick out of quorum: leader decision
> Quorum failed: (1 > total/2)
```

3. Create a program that demonstrates RAID data handling for RAID0, RAID1, RAID10, RAID5, and RAID6.
  - a. Define the data type for RAID data storage, for example, an array(raid) of array(disk) of byte of array(data stripe).
  - b. Write a string([]byte) into the RAID at position 0 with a length N, where N should be greater than the size of one stripe.
  - c. Clear one of the disks in the RAID, setting it to zero.
  - d. Read the data in the RAID from 0 to N, convert it back to a string, and print it.

Please provide projects of go lang (including go.mod & go.sum)

P.S. You can use any third-party lib for the go lang project