BLG223E
Homework-2

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Dr. Yusuf Huseyin Sahin
sahinyu@itu.edu.tr

- Please write your own codes, copying code parts from books, websites or any other source including your friends is considered as plagiarism and results in penalty. Also disciplinary actions will be taken.
- Do not upload your codes to any public platform (e.g. Github) until the deadline of homework passes.
- Your code should be able to be compiled with default g++ compiler and run under Ubuntu OS. **Even if you write your code on a different OS, you should check it via ITU SSH.**
- Do not forget to comment your code.
- Submit your source codes and report files on Ninova before the deadline, late submissions and submissions via e-mail will not be accepted.
- You are **not** allowed to use STL.
- If you have any questions, please use the message board.

1 Overview

In this homework you will simulate a Pokemon battle where a Pikachu is fighting against a Blastoise. For that problem I simpliffed the Pokemon fighting procedures given in [1]. In the simplified procedure, there are two attributes of each Pokemon: HP and PP.

HP (Health Points): Total health of a Pokemon. May be decreased after attack of the opponent. No defense mechanism is included.

PP (Power Points): Total ability to do an attack. Each Pokemon starts with a total of 100 PP and it decreases according to each attack's PP values. If Skip attack is used, +100 PP is obtained.

Also for an attack there are four different attributes:

[1] https://www.math.miami.edu/~jam/azure/pokedex

PP: To do an attack, PP value of the selected attack should be decreased from Pokemon's own PP. If this value is greater than the Pokemon's PP, attack cannot be used.

Accuracy: Accuracy of an attack. If it is not an attack with 100% accuracy, multiple nodes should be created in the graph.

Damage: Damage of the attack.

FirstUsage: The first level of the graph where the attack may be used.

To simulate the graph you should create a graph. Some important rules for creating the graph are given below.

- The HPs of Pikachu and Blastoise are 273 and 361 respectively. Attack properties of them are given in the code. **However, if you have trouble creating the graph due to low RAM space, you can use 200 HP as specified in the code.**
- A node is a leaf node, if one of the competitors are knocked-out or the level limit of the tree is reached. No children of a leaf node is allowed.
- In the simulation, it is taught that Pokemons are not using a decision mechanism to select an attack. Thus, for a list of attacks, it is equally likely to select one of them.

The graph's first three levels are given in the figure below.

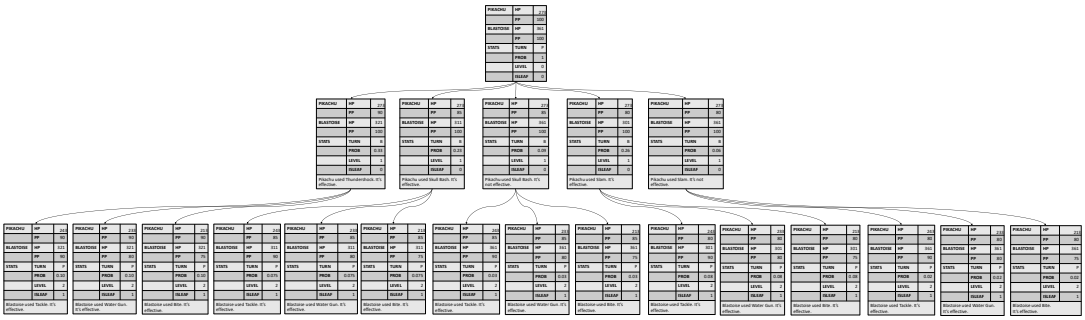

Figure 1: First three layers of the match

2 Graph Implementation (40 pts.)

Using the given skeleton code, create a graph according to the rules given in the Overview section. You should create the graph according to the max-level value given in the graph.

Your code here should output the last layer's node information. Some example runs are given below:

```
.\main part1 0
P_HP:200 P_PP:100 B_HP:200 B_PP:100 PROB:1
```

```
.\main part1 1
P_HP:200 P_PP:90 B_HP:160 B_PP:100 PROB:0.333333
P_HP:200 P_PP:85 B_HP:150 B_PP:100 PROB:0.233333
P_HP:200 P_PP:85 B_HP:200 B_PP:100 PROB:0.1
P_HP:200 P_PP:80 B_HP:140 B_PP:100 PROB:0.266667
P_HP:200 P_PP:80 B_HP:200 B_PP:100 PROB:0.0666667
```

```
.\main part1 2
P_HP:170 P_PP:90 B_HP:160 B_PP:90 PROB:0.111111
P_HP:160 P_PP:90 B_HP:160 B_PP:80 PROB:0.111111
P_HP:140 P_PP:90 B_HP:160 B_PP:75 PROB:0.111111
P_HP:170 P_PP:85 B_HP:150 B_PP:90 PROB:0.0777778
P_HP:160 P_PP:85 B_HP:150 B_PP:80 PROB:0.0777778
P_HP:140 P_PP:85 B_HP:150 B_PP:75 PROB:0.0777778
P_HP:170 P_PP:85 B_HP:200 B_PP:90 PROB:0.0333333
P_HP:160 P_PP:85 B_HP:200 B_PP:80 PROB:0.0333333
P_HP:140 P_PP:85 B_HP:200 B_PP:75 PROB:0.0333333
P_HP:170 P_PP:80 B_HP:140 B_PP:90 PROB:0.0888889
P_HP:160 P_PP:80 B_HP:140 B_PP:80 PROB:0.0888889
P_HP:140 P_PP:80 B_HP:140 B_PP:75 PROB:0.0888889
P_HP:170 P_PP:80 B_HP:200 B_PP:90 PROB:0.0222222
P_HP:160 P_PP:80 B_HP:200 B_PP:80 PROB:0.0222222
P_HP:140 P_PP:80 B_HP:200 B_PP:75 PROB:0.0222222
```

3 Probability of the Easiest Path (60 pts.)

For both Pikachu and Blastoise, find out the probability of the easiest action sequence (containing minimum number of levels) to win the battle. Your code should be run by "./main part2 pikachu" or "./main part2 blastoise" Select one of the algorithms in the previous part to solve the problem. An example output is given below.

```
.\main part2 pikachu
Pikachu used slam: effective
Blastoise used bite: effective
Pikachu used slam: effective
Blastoise used skip: effective
Pikachu used slam: effective
Blastoise used skip: effective
Pikachu used slam: effective
Level count: 7
Probabilty: 4.44444e-05
```