LAB 7   Mahjong

Introduction:

Mahjong is a game originated in China. Because the rule of mahjong differs in each districts and the rule of the International Standard Mahjong is complicated, we will use the rule of Japanese mahjong in this lab. In this lab, you are required to write a c or cpp program to calculate the points of a complete mahjong hand.

Because it is difficult to find some terms in English, I will give the romaji and its definition instead. If there is any conflict between the rule I explained with the rule you know, please write the program with the rule I explained in this pdf.

Method of Calculating points:

To calculate the points of a complete mahjong hand, we should know the value of *fan* and *fu* first, which will be explained after. Assume the value of *fan* is n, the value of *fu* is m. Then, the fundamental points of a complete mahjong hand is

$a=m*2^{(n+2)}$ when $0<n<5$

$a=2000$ when $n=5$

$a=3000$ when $6<=n<=7$

$a=4000$ when $8<=n<=10$

$a=6000$ when $11<=n<=12$

$a=(n/13)*8000$ when $13<=n$ (keep the integer part of (n/13))

Then, if the player is the banker, the final points of the mahjong hand is *a*6*. If the player is not the banker, the final points of the mahjong hand is *a*4*. The final points should be the integer times of 100. If it is not, the points should be added to be the least integer times.

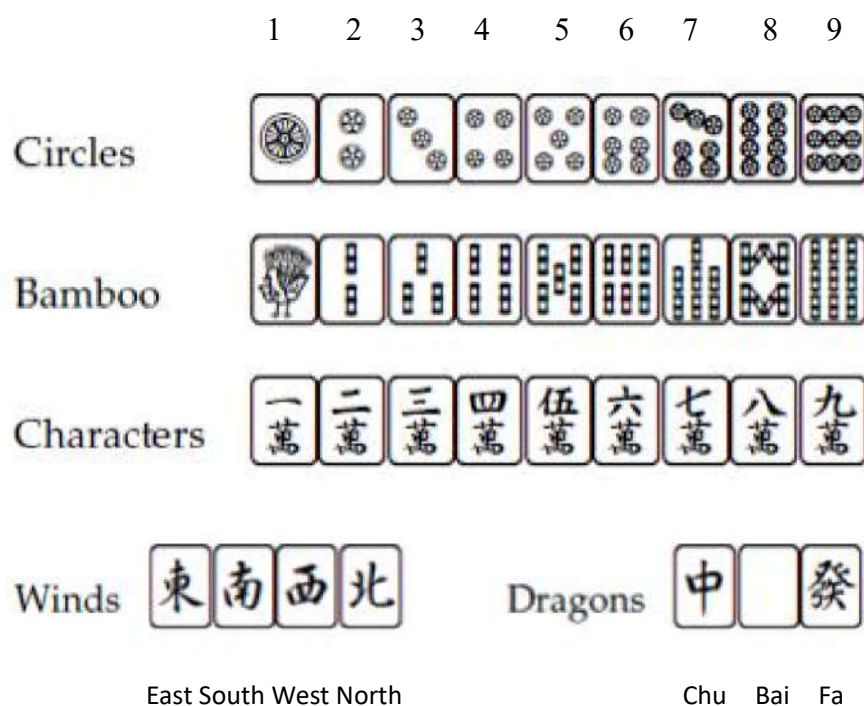Note that when n/13=1, it is called Yakuman. And let k=n/13, if k>1, it is called k times Yakuman.

Definitions

In this part, I will give some definitions of Japanese mahjong terms. If you don't understand some terms, you could look for them in this part. However, you don't need to understand everything in this part, because not everything in this part is meaningful to your programming.

Tiles:

Japanese mahjong has 136 tiles in total, 34 kinds in total. And every kind has 4 tiles in a set of mahjong. There are circle tiles, bamboo tiles and character tiles, each kind has tiles numbered from 1 to 9. In addition to them, there are 4 kinds wind tiles and 3 kinds dragon tiles.

    1   2   3   4   5   6   7   8   9

Circles

Bamboo

Characters

Winds

Dragons

East South West North   Chu Bai Fa

Suit tiles: All the circle tiles, bamboo tiles and character tiles are suit tiles.

Honor tiles: All the wind tiles, dragon tiles are honor tiles.

Middle tiles: All the suit tiles numbered 2 to 8.

Yaochu tiles: All the suit tiles numbered 1 or 9 and all the honor tiles.

Loto tiles: All the suit tiles numbered 1 or 9.

Mentsu: Mentsu consists of sequence, triplet and kantsu.

Pair: A pair consists of two identical tiles.

Sequence: A sequence consists of three continuous tiles. Note that the tiles of a sequence must be the same kind of suit tiles. For example,

Triplet: A triplet consists of three or four identical tiles. Sometimes we differ it from the kantsu.

Concealed triplet: The triplet in your hand when you win or the concealed kantsu.

Exposed triplet: The triplet formed by two tiles in your hand and one tiles others discard.

Kantsu: A kantsu consist of four identical tiles. It is a special kind of triplet. Note that if you want to with a kantsu, it must be in your meihai, which will be explained later in the "how to win" part.

Concealed kantsu: The kantsu formed by four tiles in your hand.

Exposed kantsu: The kantsu formed by three tiles in your hand and a tile other discards or kakan.

Kakan: Use a tile in your hand and a triplet in your meihai to form an exposed kantsu.

Meihai: 1.Use two tiles in your hand and a tile others discard to form a sequence or a triplet.

2. Use three tiles in your hand and a tile others discard to form an exposed kantsu. 3. Use four tiles in your hand to form a concealed kantsu. 4. Kakan.

Menzen: The situation a player doesn't have meihai, except for concealed kantsu.

Prevailing wind: East or south or west or north. It changes with the process of game.

Dealer's wind: East or south or west or north. It changes with the seats of you sit on at the beginning of the game.

Ready hand: If you have one more certain tile, then you will win. At that time you have a ready hand.

Banker: If one is the banker, his or her dealer's hand is east.

Lichi: Discard a tile to river and put it horizontally. After lichi, you must have ready hand and you couldn't change your hand until you win.

Red dola: In Japanese mahjong, some tiles are dyed red. They are called red dola, a kind of dola tiles, which we will discussed in "calculation of fan" part.

Yakuman: When winning, your fundamental points $a=(n/13)*8000$, when $n/13=1$, it is called Yakuman. And let $k=n/13$, if $k>1$, it is called k times Yakuman.
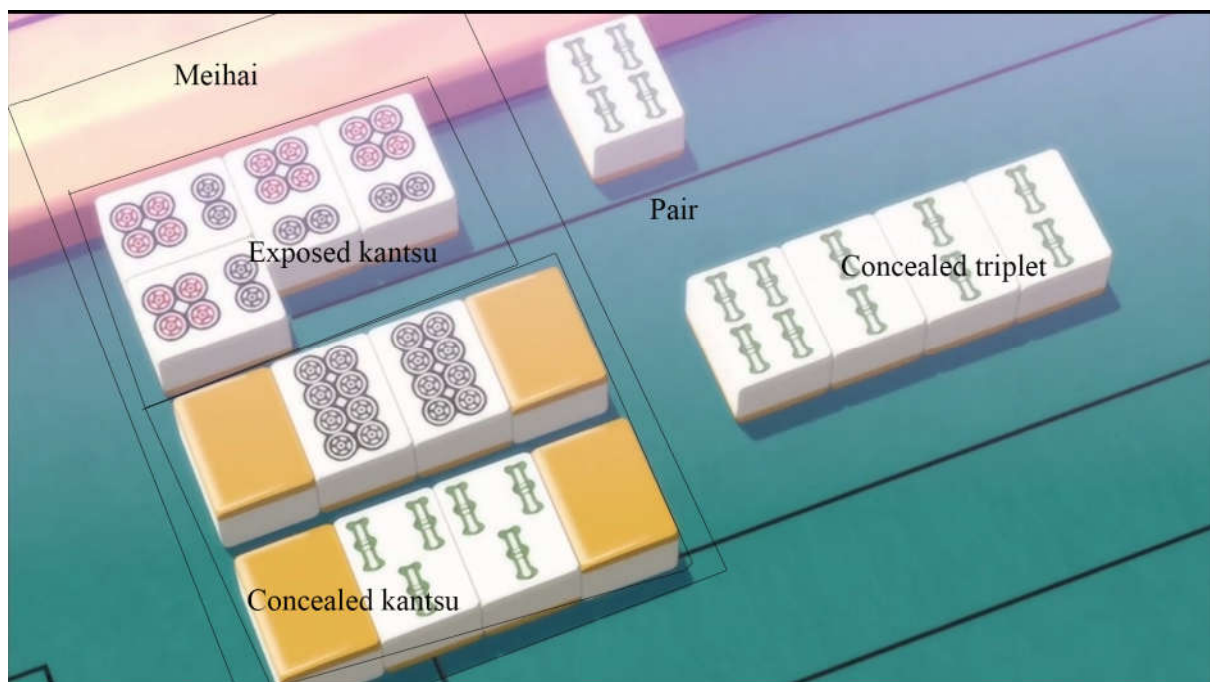
How to win

If you want to win, you must have four mentsu and a pair in your hand and your meihai.

Usually a player will have 14 tiles when winning. But if the player has kantsu, he or she will have 14 plus the number of kantsu he or she has.

There are two special situations that you don't have four mentsu and a pair but you still can win: seven pairs , kokushimusou and shinkokushimusou, which will be discussed in "Calculation of fan".

Note that in Japanese mahjong, you can't win when your *fan* is less than 1.

Note that before calculating points, the mahjong hand should be divided into certain groups and the groups can't be changed in the calculation. For example, 1s,1s,1s,2s,2s,2s,3s,3s,3s,6p,6p,0e,0e,0e can't divided into four triplets 1s1s1s, 2s2s2s, 3s3s,3s, 0e0e0e and a pair 6p6p or three sequences 1s2s3s, 1s2s3s,1s2s3s, a triplet 0e0e0e and a pair 6p6p. You should calculate the points in this two method of grouping and choose the one which has more points.

The method of win: In general, you can win in two ways: 1. You get the last tile by drawing a tile. 2. You get the last tile by others discarding.

Calculation of fan

1. **Menzen tsumo:** If you win in the menzen situation and get the last tile by drawing, fan + 1.

2. **Honor mentsu:** Whenever you have a triplet or kantsu consist of prevailing wind or dealer's wind or dragon tiles, fan + 1. (Note that a triplet or kantsu which is the same as the prevailing wind and the dealer's wind will contribute 2 fan)   e.g. 0b,0b,0b

3. **Lichi:** When you lichi, fan + 1.

4. **W lichi:** If you lichi in your first turn, fan + 2.

5. **Danyao:** Your winning hand has no Yaochu tiles.   fan + 1.

e.g. 2m,2m,2m,8m,8m,5p,5p,5p,4s,5s,5s,6s,6s,7s

6. **Common hand:** Your winning hand is composed of 4 sequences and a pair. And your last tile is the side tile of a sequence and the other tile couldn't consist suit tile numbered 1 or 9. The tiles of your pair couldn't be the same as the prevailing wind or dealer's wind or the dragon tiles. fan + 1.   e.g. 2m,3m,4m,6p,7p,7p,8p,9p,2s,3s,5s,5s,4s

7. **Ipatsu:** Win in 1 turn after lichi if no one meihai in this turn. fan + 1.

8. **Ipeko:** Your winning hand has two same sequences. Only in menzen, fan + 1.

E.g. 1s,1s,2s,2s,3s,3s,6p,6p,6p,0b,0b,0b,0z,0z

9. **Apeko:** Your winning hand has two sets of ipeko. Only in menzen, fan + 3. Note that if you calculate apeko, you shouldn't calculate ipeko.

E.g. 1s,1s,2s,2s,3s,3s,2p,2p,3p,3p,4p,4p,1m,1m

10. **Chakan**: If others kakan, that tile is what you wait for to win, then you can win with that tile. fan + 1.

11. **Linshankaihou:** When you form a kantsu, you will draw a linshan tile. If you win with the tile at that time, fan + 1.

12. **Hoteilaoyui:** If you win with the tile others discard after he or she draws the last tile in the mountain, fan + 1.

13. **Haiteilaoyu:** If you win with the tile you draw, which is the last tile in the mountain, fan + 1.

14. **Ikitsukan:** If you winning with the sequences 123,456,789 of the same kind of suit tiles, fan + 2 when menzen, fan + 1 when not menzen.

E.g. 1s,2s,3s,4s,5s,6s,7s,8s,9s,2p,2p,2p,0e,0e

15. **Junior three chiefs:** If you have two triplet consisting of dragon tiles and a pair consisting of dragon tiles, fan + 2.   e.g. 1s,2s,3s,2p,2p,2p,0b,0b,0b,0z,0z,0z,0f,0f

16. **Sanshukutojun:** If you have three sequences numbered the same, but consist of three kinds of suit tiles, fan + 2 when menzen, fan + 1 when not menzen.

E.g. 1s,2s,3s,1m,2m,3m,1p,2p,3p,5p,5p,5p,0e,0e

17. **Sanshukutoko:** If you have three triplets numbered the same, but consist of three kinds of suit tiles, fan + 2. e.g. 4s,4s,4s,5s,6s,7s,4p,4p,4p,4m,4m,4m,0z,0z

18. **Sanankou:** The winning hand consists of three concealed triplet or kantsu. fan + 2

19. **Sankantsu:** If you have three kantsu, fan + 2.

20. **Zenobiyao:** Every mentsu and pair consist a yaochu tile at least (must consisting honor tiles) and having a sequence at least. fan + 2 when menzen, fan + 1 when not menzen.

E.g. 1s,2s,3s,9p,9p,9p,7m,8m,9m,0e,0e,0e,0z,0z

21. **Chunzenobiyao:** Every mentsu and pair consists of loto tile, fan + 3 when menzen, fan + 2 when not menzen.   E.g. 1s,2s,3s,9s,9s,1p,1p,1p,7p,8p,9p,1m,2m,3m

22. **Honloto:** Every tile in your winning hand is yanchu tile (must containing loto tile and honor tile), fan + 2. e.g. 1s,1s,1s,9s,9s,9s,9p,9p,9p,0e,0e,0e,0z,0z

23. **Toitoi:** All the mentsu is triplet or kantsu, fan + 2.

e.g. 1s,1s,1s,5s,5s,5s,6p,6p,6p,8m,8m,8m,0e,0e

24. **Seven pairs:** Your winning hand is composed of 7 pairs instead of a pair and 4 mentsu, fan + 2. e.g. 2s,2s,5s,5s,6p,6p,8p,8p,4m,4m,5m,5m,0e,0e

25. **Mixed one suit:** Your winning hand consist of honor tile and one kind of suit tile,

fan + 3 when menzen, fan + 2 when not menzen. E.g. 1s,2s,3s,4s,4s,4s,5s,6s,6s,7s,7s,8s,0e,0e

26. **Pure one suit:** Your winning hand consist of only one kind of suit tile, fan + 6 when menzen, fan + 5 when not menzen. E.g. 1s,2s,3s,4s,4s,4s,5s,6s,6s,7s,7s,8s,9s,9s

27. **Dola:** In one game, some tiles are dola. Dola contains red dola and the dola indicated by dola indicators. If you win (fan>=1), assume you have n dola tiles, fan + n.

Every indicator of dola means the next tile of it is dola.

For suit tiles: 1p->2p->...->9p->1p,   1s->2s->...->9s->1s,   1m->2m->...->9m->1m

For honor tiles: 0e->0x->0w->0n->0e (east->south->west->north->east) 0b->0f->0z->0b

28. **Natural win:** The banker wins after he or she draws the first tile of the game. Yakuman.

29. **Earthly hand:** The player (not the banker) wins after he or she draws the first tile if there is no one meihai before. Yakuman.

30. **Person hand:** The player (not the banker) wins with the tile others discard in the first turn if there is no one meihai before. Yakuman.

31. **Junior four happiness:** Winning with three triplet consisting of three kinds wind tiles and the pair consisting of the other kind of wind tiles. Yakuman.

E.g. 5p,6p,7p,0e,0e,0e,0x,0x,0x,0w,0w,0w,0n,0n

32. **Sikantsu:** Winning with four kantsu. Yakuman.

33. **Siankou:** Winning with four concealed triplet or kantsu and the last tile you get is not the tile of pair. (Note that you could only win in this way by drawing your last tile, because if the last tile is discarded by others, your last triplet is exposed.) Yakuman.

E.g. 2s,2s,2s,5s,5s,5s,6p,6p,6p,8p,8p,6m,6m,8p

34. **Chinloutou:** Winning hand only consists of loto tile. Yakuman

E.g. 1s,1s,1s,9s,9s,9s,1p,1p,1p,9p,9p,9m,9m,9m

35. **Tsuiso:** Winning hand only consists of honor tile. Yakuman

E.g. 0e,0e,0e,0w,0w,0w,0n,0n,0z,0z,0z,0b,0b,0b

36. **Lyuiso:** Winning hand only consists of bamboo 2, bamboo 3, bamboo 4, bamboo 6, bamboo 8 and fa (a kind of dragon tile). In other words, all the tiles are green. Yakuman.

E.g. 2s,3s,4s,4s,4s,6s,6s,6s,8s,8s,8s,0f,0f,0f

37. **Grand three chiefs:** Winning hand consists of three triplets of three kinds of dragon tiles. Yakuman   e.g. 2s,3s,4s,5p,5p,0z,0z,0z,0b,0b,0b,0f,0f,0f

38. **Chulenpouton:** Firstly, it must be pure one suit in menzen. What's more, its number is 1112345678999 and an arbitrary number. If your ready hand is not 1112345678999, yakuman.   E.g. 1s,1s,1s,2s,2s,3s,4s,6s,7s,8s,9s,9s,9s,5s

39. **Kokushimusou**: The winning hand consist of 13 kinds of yaochu tiles (Of course in menzen). In other words, every kinds of yaochu tiles has one add one arbitrary yaochu tiles. If your ready hand before winning doesn't consist of 13 kinds of yaochu tiles, yakuman.

E.g. 1s,9s,1p,9p,1m,1m,0e,0w,0x,0n,0b,0f,0z,9m

40. **Grand four happiness:** Winning hand consists of four triplets of four kinds of wind tiles. Twice yakuman.   E.g. 0e,0e,0e,0w,0w,0w,0x,0x,0x,0n,0n,0n,2s,2s

41. **Siankoudanji:** Winning with four concealed triplet or kantsu and the last tile you get is the tile of pair. Twice yakuman.   E.g. 2s,2s,2s,5p,5p,5p,8p,8p,8p,2m,2m,2m,0z,0z

42. **Junsaichulenpouton:** Firstly, it must be pure one suit in menzen. What's more, its number is 1112345678999 and an arbitrary number. If your ready hand is 1112345678999,

twice yakuman.　E.g. 1m,1m,1m,2m,3m,4m,5m,6m,7m,8m,9m,9m,9m,1m

43. **Shinkokushimusou:** The winning hand consist of 13 kinds of yaochu tiles (Of course in menzen). In other words, every kinds of yaochu tiles has one add one arbitrary yaochu tiles. If your ready hand before winning consists of 13 kinds of yaochu tiles, twice yakuman.　E.g. 1p,9p,1s,9s,1m,9m,0e,0x,0w,0n,0b,0f,0z,0z

Note that the method of calculation of fan, if the method will contribute yakuman or twice yakuman, it is called yakuman hand. Yakuman hand and other methods which aren't yakuman hand can't be calculated at the same time. However, yakuman hand can be calculated repeatedly.

Calculation of fu

1. When you win the game, your fu will be 20 at least.

2. When menzen and your last tile is the tile others discard, fu + 10.

3. If you get the last tile by drawing a tile, fu + 2.

4. Before you win (when you have a ready hand):

    A. If you are waiting for a tile to make a pair, fu + 2.

    B. If you are waiting for a tile to make a sequence and the tile is in the middle of the sequence, fu + 2. For example, you have circle 1 and circle 3, waiting for circle 2.

    C. If you are waiting for a tile to make a sequence and the tile is in the side of the sequence and the other two tiles of the sequence contain 1 or 9, fu + 2. For example, you have bamboo 1 and bamboo 2, waiting for bamboo 3. Or you have character 8 and character 9, waiting for character 7.

5. If your pair satisfies any condition below:

A. The same as prevailing wind, fu + 2.

B. The same as dealer's wind, fu + 2.

C. Dragon tiles, fu + 2.

Note that A and B can be calculated at the same time if the prevailing wind is the same as the dealer's hand.

6. If your mentsu satisfy any condition below:

	Exposed triplet	Concealed triplet	Exposed kantsu	Concealed kantsu
Middle tile	+2	+4	+8	+16
Yaochu tile	+4	+8	+16	+32

7. Special conditions: If your winning hand satisfies the conditions in this part, there is no need to calculate fu from the former 5 steps.

A. If you win with seven pairs or kokushimusou or shinkokushimusou, fu = 25.

B. If you win with a common hand and get your last tile by drawing, fu = 20.

C. If you win with a common hand and get your last tile by others discard, fu = 30.

8. At last, your fu should be integer times of 10. If it is not, add it to be the least integer times of 10.

Input:

First line: a1 a2 a3 a4 a5 a6 a7 a8

a1: the number of tiles in hand.

a2: lichi or not. 0: not lichi, 1: lichi, 2: w lichi

a3: Where the last tile come from. 0: others discard 1:drawing 2: linshan 3: Hoteilaoyui 4:Haiteilaoyu 5: Chakan   (actually, from others: 0,3,5, by drawing:1,2,4)

a4: dealer's wind. 1: east 2: south 3: west 4: north

a5: prevailing's wind. 1: east 2: south 3: west 4: north
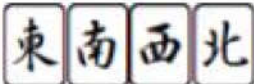
a6: there is ipatsu or not. 0: no 1: yes.

a7: whether there is natural win or earthly win or person win. 0: no 1: yes.

a8: the number of red dola in the mahjong hand.

Second line: a string showing the tiles in the player's hand (except for the meihai)

Every tile is described by one number and one character, which is shown below. And every two tile is split by a comma. The last tile in the line is the last tile the player get. For example, 3m,4m,6m,7m,8m,3s,3s,2p,3p,4p,5p,6p,7p,2m   (may not in order)

Third line: n   (n is the number of set of meihai)

4th-(2n+3)th line: Even row: a   (0: concealed   1: exposed)

Odd row: a string showing the set of meihai (in order)

(2n+4)th line: All the indicators of dola.

Every indicator of dola means the next tile of it is dola.
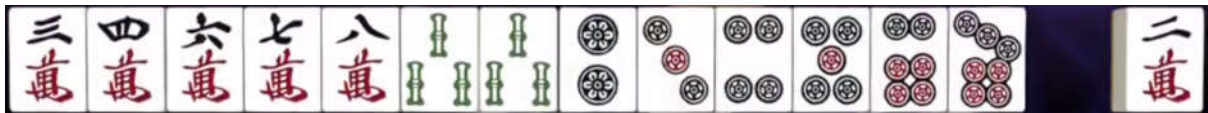
For suit tiles: 1p->2p->...->9p->1p,   1s->2s->...->9s->1s,   1m->2m->...->9m->1m

For honor tiles: 0e->0x->0w->0n->0e (east->south->west->north->east) 0b->0f->0z->0b

Output:

First line: a number, the points the player will get.

Example:

Input:

14 1 1 1 1 1 0 0
3m,4m,6m,7m,8m,3s,3s,2p,3p,4p,5p,6p,7p,2m
0
5s

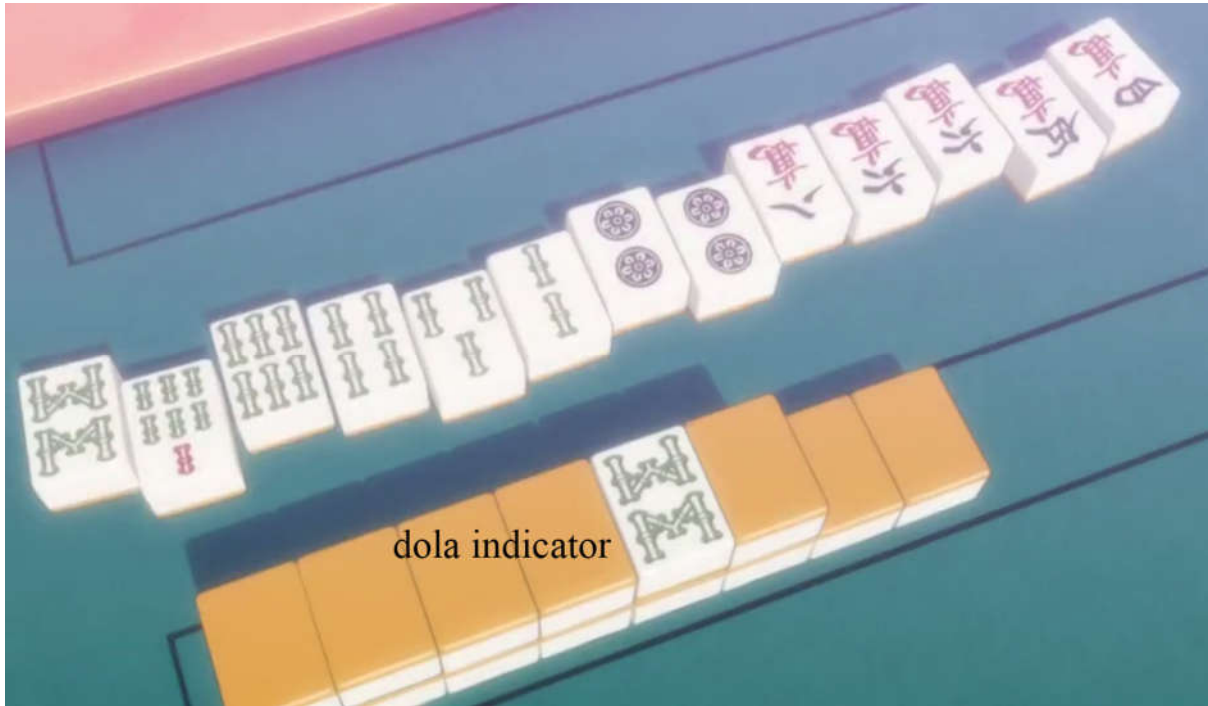Output:

12000

Explanation:

Calculation of fan: Menzen tsumo+lichi+ipatsu+danyao+common hand=5

Calculation of fu (actually there is no need):   20

                                    the special situation: common hand+get the last tile by drawing

Points=2000*6=12000   (Since the player is the banker).

Input:

14 0 0 3 1 0 0 0
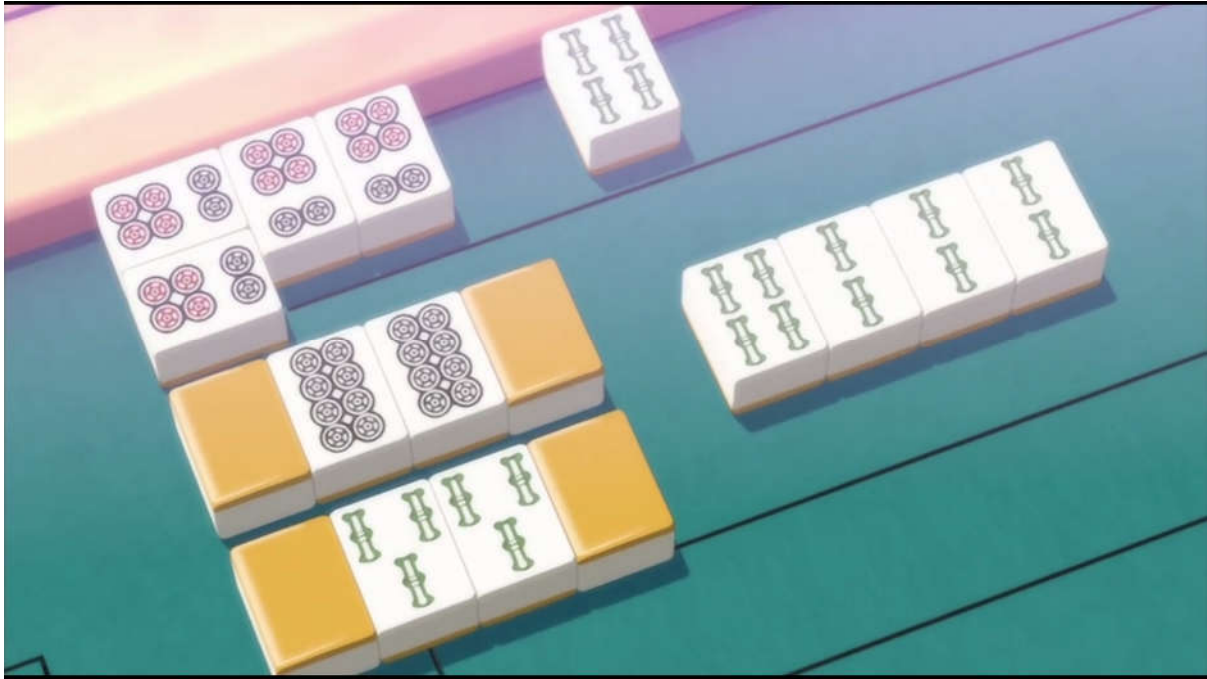4m,5m,6m,6m,8m,2p,2p,2s,3s,4s,6s,7s,8s,7m
0
8s

Output:

1300

Explanation:

Calculation of fan: only danyao   fan=1

Calculation of fu: 20+10+2=32->40   fu=40. Getting the last tile from others +10, waiting for

the tile 7m, which is the middle tile in the sequence 6m,7m,8m, +2.

Points=40*2^(1+2)*4=1280->1300 (Since the player isn't the banker)

Input:

17 0 2 1 2 0 0 0
2s,2s,2s,4s,4s
3
1
6p,6p,6p,6p
0
8p,8p,8p,8p
0
3s,3s,3s,3s
9m,9p,5s,2m

Output:

24000

Explanation

Calculation of fan: linshankaihou+danyao+toitoi+sanankou+sankantsu=8

Calculation of fu (actually no need): 20+2+2+4+8+16*2=68->70

   Getting the last tile by drawing +2, waiting for tile to make the pair +2, a concealed

   triplet +4, an exposed kantsu +8, two concealed kantsu +16*2

Points=4000*6=24000   (Since the player is the banker)

Requirement:

Use document input and output. The input document will be named "input_i.txt" (i is a number). Please output all the results in one document.

Goal I: (If this lab is too difficult for you, you can only finish this goal)

Only judge whether this mahjong hand can win. Ignore the the rule of fan>1, but consider seven pairs, kokushimusou and shinkokushimusou. You will get 25 points. (75 points in all)

Goal II:

Please try to finish all of this lab. Although it seems complex, if you have a clear thinking, every condition will be finished in only about 10 lines. You don't need to consider something that is even impossible in manga (for example, can the natural win and siankoudanji happen at the same time). If you have any problem about the lab, feel free to ask us. Please start early.