Assignment 2

The Sword in the Stone

Version 2.1

1. Introduction

Ultimecia, the most powerful sorceress of all time, due to emotional suffering, decided to terminate all humanity with the magic of *time compression*. Thereby the past, present and future will be merged together and cease to exist. Without the past, the present, and the future, there will be no more nostalgia, aspirations and development, humanity will no longer exist.

In order to perform the time compression, Ultimecia planted a rose in the back of the garden. The rose petals will fall over time. When the final rose petal falls, the time compression will be completed. If a knight ever defeated Ultimecia before the final red petal touched the ground, she would cancel her decision and humanity would be rescued from the disaster.

To defeat Ultimecia, the Arthur's legendary Excalibur sword is needed. King Arthur, after defeating Bowser and saving Princess Guinevere, re-attached the Excalibur to the stone. Then, he bid farewell to the throne and knight life, went with Princess Guinevere to hide in the wilderness. To retrieve the Excalibur from the stone, three treasures are needed: the Paladin's shield, the Lancelot's spear and the Guinevere hair. These treasures are hidden in various large and ancient England castles.

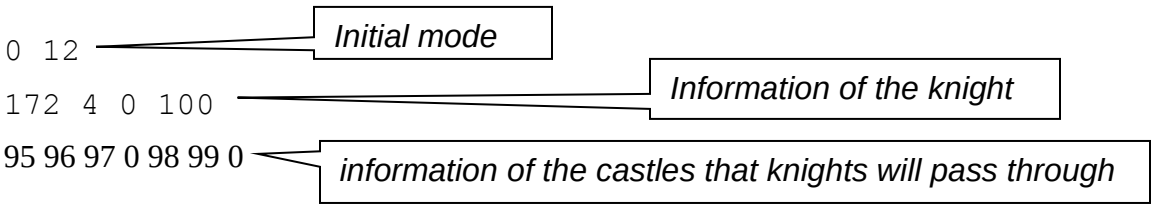
Even when drawn from the stone, the Excalibur can only be used by a Round Table knight. So once again the Knights of the Round Table faced a new, challenging and glorious task: rediscovering the sword in stone, defeating Ultimecia and saving humanity. Should the sword in the stone be drawn before the last red petal falls, will Ultimecia give up the extreme intentions of her misery. All will be answered in this assignment.

2. Requirement

In this big exercise, students will be provided with a file containing input, including information about the initial mode of the program, information about the Knight of the Round Table looking for the swords in the stone and the castles to be explored. Students will implement a special function called *walkthrough*, whose details are discussed in more detail in Part 4.

3. Input

Program input is stored in a file named input.txt, which contains the following information.



Thus, the input file will have at least 3 lines. The first line describe the initial mode, whose format is as follows.

mode petals

where:

- *mode*: The execution mode of the program. If *mode* = 0, the program executes in normal mode. The explanations in Section 4 from article a to article u are for mode 0. Other modes of 0 will be explained in article v and article x of Section 4.
- *petal*: The number of petals on the rose in the Ultimecia home garden, is an integer from 0 to 99

The second line describe the information of the Knight of the Round Table, whose format is as follows.

HP level antidote gil

where:

- *HP*: The knight's health point, is an integer value from 1 to 999. This is also the knight's *maxHP*.
- *level*: The level of the knight, is an integer from 1..10

- *antidote*: The number of antidote that the knight carries, is an integer in 0..99
- *gil*: The money that the knight carries, is an integer in 1..999.

The journey to find the sword in the rock will be described from the third line. The journey will pass through many castles, each of which includes many events. Each event will be described by a numeric value, called the *event code*. The corresponding meanings of each event are described in Table 1. Events in different castles are separated by 0. The number of events and the number of castles are not fixed, may vary depending on the test case. An event can occur many times. A maximum of 100 events will occur. Each castle has a maximum of 20 events. If the number of events is large, events may be displayed in multiple lines. In each castle, each event will be indexed starting from 1, when passing through the new castle, the event index will be reset from 1.

Example 1. With the given input as

0 12

```
172 4 0 100
```

95 96 97 0 98 99 0

then the program will execute in mode 0, with all 12 rose petals. The Knight of the Round Table looking for a sword in the stone will have *HP* as 172, a level of 4, without antidote, and have 100 gil. On the other hand, the knight's *MaxHP* is also 172 (meaning the knight's HP will never exceed 172, unless MaxHP changes afterward).

Along the way, the knight will pass through two castles, with the following events occurring.

Castle 1

Event 1: Meet Paladin's shield

Event 2: Meet Lancelot's spear

Event 3: Meet Guinevere's hair

Castle 2

Event 1: Meet the Excalibur Sword

Event 2: Meet Ultimecia

4. Implementation

Student will implement a function called *walkthrough* whose prototype is as follows.

report walkthrough (knight& theKnight, castle arrCastle[], int nCastle, int mode, int nPetal)*

where *report* is a *struct* whose declaration is as follows.

```
struct report
{
int nPetal;
int nWin;
int nLose;
}
```

where *nPetal* is the number of petals remained after the knight defeats Ultimecia, *nWin* and *nLose* are respectively the number of victories and defeats the knight gets once looking for the sword in the stone.

The knight's information is decribed in the reference variable of struct *knight*, declared as follows.

```
struct knight
{
int HP;
int level;
int antidote;
int gil;
}
```

where the members of *HP*, *level*, *antidote* and *gil* are corresponding to the knight's *HP*, *level*, *antidote* and *gil*.

The castles' information is passed by the variable of *arrCastle*, is an array of castle *struct*, whose declaration is as follows.

```
struct castle
{
int arrEvent[20];
int nEvent;
```

}

The variable *nCastle* indicates the number the castles the knight must pass, whereas the *mode* and *nPetal* variables provide information about the program's execution mode and the initial rose petals. The knight will go over the events in the *arrCastle* array in turn (will be stored in the order of the events described in the input.txt file). Every time the knight went through an event, a petal would fall down. If the number of petals is zero and the knight has not yet won against Ultimecia, the walkthrough function will terminate and return the NULL value.

Example 2. With the given input as

0 1

```
172 4 0 100
```

95 96 97 0 98 99 0

At the 1st event at the 1st castle, the knight picked up the Paladin's shield. However, since there is only 1 rose petal, after the knight picks up the shield, the rose petals fall down, the walkthrough function will return NULL value

In the process of searching for the sword, the knight's information will change based on the events the knight meets along the way, specified as follows

a) If the knight meets Ultimecia and has the Excalibur sword, the knight will defeat Ultimecia, the *walkthrough* function will terminate and return a corresponding report structure. In constrast, without the Excalibur, the knight would be defeated by Ultimecia, and the knight's *HP* would be reduced as follows: HP = HP / 3 (rounded as integer). If the knight's *HP* is less than 3, the knight's *HP* will be reduced to 1.

b) If the knight meets the Excalibur without having all three treasures, the knight will not be able to draw this sword and will continue his journey to the next event. If all three treasures were obtained, the knight would draw this sword and continue the journey to find Ultimecia.

c) When passing through a castle, the knight's level will be increased by 1, but the level is not by greater than 10. If having passed through all the castles, the knight will return to the beginning (ie. starting again from the 1st event of the 1st castle). Every time the level is increased, the knight's *MaxHP* will be increased by 100, however *MaxHP* cannot exceed 999.

Note: In all test cases, events 95, 96, 97, 98 and 99 (picking up 3 treasures, meeting the Excalibur sword and meeting Ultimecia) will always occur.

Example 3. With the given input as

0 12

```
172 4 0 100
```

95 96 97 0 98 99 0

After 3 events at the 1st castle, the knight picked up all three treasures. After leaving the castle 1, the knight's level will be increased by 1 (level = 5) and the number of rose petals will be 12-3 = 9. Going to event 1 at Castle 2, the knight withdrew Excalibur because he had 3 treasures. At the 2nd event in castle 2, the knight meets Ultimecia and wins, now there will be 9-2 = 7 rose petals. So the information of *theKnight* variable when winning will be {172,5,0,100}. The returned result of the *walkthroug*h function will be a pointer to the structure whose value is {7,1,0}, ie. 7 petals left, winning 1 match (winning Ultimecia) and losing 0 matches. (Note that the knight's *MaxHP* is now increased to 272, but the knight's *HP* is still 172).

Example 4. With the given input as

0 8

```
172 4 0 100
```

96 98 99 0 97 95 0

At the 1st event, the knight picked up Lancelot's spear, then in the second event he met the Excalibur sword but could not pull out of the stone since he has not obtained three treasures. By the 3rd event, the knight is defeated by Ultimecia, the knight's HP will be 57. After leaving the 1st castle, the knight's level will be increased by 1 (level = 5) and the number of rose petals will be 8-3 = 5. To the 2nd castle, the knight picked up the remaining 2 treasures, the number of rose petals left is 5-2 = 3. After leaving the 2nd castle, the knight's level continued to rise by 1 (level = 6). Having gone to all the castles, the knights would return to the beginning, starting from Castle 1. This time the knight drew the Excalipur sword and defeated Ultimecia, just as the last petal fell. The information of *theKnight* variable when winning will be {57,6,0,100}. The returned result of the *walkthrough* function will be a pointer to the struct whose value is {0,1,1}; which means there are 0 petals left, won 1 match and lost 1 match.

d)) If encountering an event of from 1 to 5, the knight must engage with the corresponding opponent. Each opponent will also have their own *levelO* level. If the opponent are met as the i^{th} event, the opponent's corresponding *levelO* will be calculated as follows.

$$b = \mathbf{i}\%10 \qquad (1)$$

$$levelO = \mathbf{i} > 6 ? (b > 5 ? b : 5) : b \qquad (2)$$

If the knight's *level* is higher than or equal to the opponent's *levelO*, the knight wins. When winning, the knight will receive a corresponding amount of *gil*, described in Table 2, but the number of gil cannot exceed 999.

If the knight's *level* is less than the opponent's *levelO*, the knight's *HP* will be calculated as follows.

$$HP = HP - damage \quad (3)$$

damage will be calculated as

$$damage = baseDamage * levelO * 10 \quad (4)$$

where *baseDamage* is depending on the opponent, described in Table 3.

If the knight has not picked up the Excalibur sword then the knight will always loses for all opponents, regardless of the level of the knight.

Note that *HP* will always be an integer when calculating by formula (3). If the HP is less than or equal to 0 after calculating by formula (3), the *walkthrough* function will automatically call the *callPhoenix* function (see also the description in Section 5 about the c*allPhoenix* function) to call the phoenix to revive the knight. When calling for the phoenix, the amount of the knight will be deducted by 100 gil. If the amount of knights is less than 100 (even if gil = 0) before calling the phoenix, the amount of knights will be reduced to 0. When revived, the knight's *HP* will be equal to 1/2 MaxHP (rounded to integer).

Example 5. With the given input as

0 8

```
4 1 0 100
```

96 98 99 0 97 95 0

After passing through Castle 1, the knight has picked up the Paladin's shield, the level is increased to 2, so *MaxHP* will be increased to 104. Go to castle 2, the knight picks up the remaining 2 treasures, picks up Excalibur sword and meet MoonBringer whose levelO is 4. The knight is defeated and HP reduced to 4 - 1.5 * 4 * 10 <0. The knight will call the phoenix and revive with HP = 104/2 = 52, *gil* is 100-100 = 0. Then the knight defeats Ultimecia and the walkthrough function ends. The knight's information is {52,2,0,0}, the report's information is {6,1,1}.

e) If meeting Tornbery, the knight will fight with Tornbery. The fighting process is similar to that described in d. If the knight wins, the knight's level will be increased by 1, but cannot be increased by 10. If losing, the knight will be poisoned in the next 5 events. When being poisoned and having to fight with opponents whose code is 1..5 or with Ultimecia, even if defeated, the knight also has reduced HP like when losing.

When poisoned, if the knight has antidote (*antidote* >= 1), the knight will automatically take this medicine and return to normal, then the knight's antidote will be reduced by 1. If the knight's HP droped to 0 or lower when the knight is poisoned, he will summon the

phoenix and be revived as described in d. Upon revival, the knight will automatically be de-poisoned. Tornbery will not fight a poisoned knight.

Table 1 – Events in the journey to find the sword in the stone

Event code	**Meaning**
1	Meeting MadBear
2	Meeting Amazon female warrior MoonBringer
3	Meeting Elf
4	Meeting Saxon warrior
5	Meeting Troll
6	Meeting Tornbery
7	Meeting Queen of Cards
8	Meeting the merry merchant Nina de Rings
9	Lost into the Durian Garden
10	Obtaining Antidote
11	Meeting Odin
12	Meeting Merlin the Wizard
13	Meeting Omega Weapon
14	Meeting Hades
15	Obtaining Scarlet Hakama
16	Meeting LockedDoor
95	Obtaining Paladin shield
96	Obtaining Lancelot’s spear
97	Obtaining Guinevere’s hair
98	Obtaining Excalibur sword
99	Encountering Ultimecia

Bảng 2 – Gil gained after defeating

Gil	**gil**
MadBear	100
MoonBringer	150
Elf	450
Saxon	650
Troll	850

Example 6. With the given input as

0 12

```
172 1 0 100
```

95 0 96 97 98 6 0 1 99 0

After passing through Castle 1, the knight picked up Paladin's shield, level = 2, MaxHP = 272. Going to Castle 2, the knight picked up the remaining 2 treasures, drew the Excalibur sword and met Tornbery with levelO is 4, the knight is defeated and poisoned. Then when the knight is out of Castle 2, level = 3, MaxHP = 372. Later in Castle 3, the knight defeats MadBear, gets additional 100 gil but the HP is still reduced to HP = 172 - 1 * 1 * 10 = 162 The knight then defeats Ultimecia but the HP is still reduced to 162/3 = 54. The *walkthrough* function ends. The knight's information is {54,3,0,200}, the report's information is {5,2,1

Table 3 – The opponent's *baseDamage*

Opponent	**baseDamage**
MadBear	1
MoonBringer	1.5
Elf	4.5
Saxon	6.5
Troll	8.5

f) If meeting the Queen of Cards, the knight will fight the queen. The fighting process is similar to that described in d. If the knight wins, the knight's *gil* will be doubled. If you lose, the knight will get half of the *gil* reduced (rounded to integer)

g) If meeting the merry merchant Nina de Rings, the knight will do the trading activities in the order described as follows:

- The knight will continue their journey and will not trade if there is less than 50 gil.

- If the knight is poisoned, the knight will give Nina 50 gil to be de-poisoned.

- If the knight still has *gil* after de-poisoned or is not poisoned, the knight will convert the *gil* into *H*P in a 1: 1 ratio until the knight runs out of money or the knight's *HP* reaches *MaxHP* value.

Example 6b. With the given input as

0 12

```
172 1 0 100
```

95 96 97 98 1 8 99 0

After collecting all 3 treasures and drawing the Excalibur sword, the knight fights MadBear having *levelO* of 5 and loses, *HP* = 172 - 1 * 5 * 10 = 122. When the knight meets Nina,

the knight will give Nina 50 gil to restore HP to MaxHP of 172. The knight then defeats Ultimecia and the walkthrough function ends. The knight's information is {172,1,0,50}, the report's information is {5,1,1}.

However, upon meeting Nina, if the knight's HP and gil numbers make up a pair of *friendly numbers* (http://en.wikipedia.org/wiki/Friendly_number), Nina will not collect money when de-poisoning and restores HP to the knight (even if the knight has less than 50 gil). Also Nina will give the knight the sword *Lionheart*. With the Lionheart sword, the knight defeats all opponents, including Ultimecia and Hades (meaning the *walkthrough* function will end if the knight has not yet pulled Excalibur but meets Ultimecia while having Lionheart). However, after 5 events, the Lionheart sword will automatically fly back to Nina and the knight will continue his journey normally. Nina never appeared more than once in 6 consecutive events.

h) If the knight lost into the Durian Garden, the knight will be de-poisoned if being poisoned, the knight's *HP* will recover to *MaxHP*, and Ultimecia's rose will automatically grow 5 more petals, but the number of rose petals never exceeds 99. When out of the Durian Garden, the rose petals still fall as usual.

i) If the knight picks up the antidote, the knight's *antidote* will increase by 1. If the knight picks up the antidote while poisoned, the antidote will be used immediately.

k) If the knight meets Odin, Odin will accompany the knight in the next 5 events. Knights with Odin will defeat all opponents with event codes from 1-7 regardless of the opponent's *levelO*. Odin never appears more than 1 time in 6 consecutive events

l) If the knight meets Merlin, Merlin will do the following actions in the order described:

- De-poisone the knight if he is poisoned.
- Increase a knight's level by 1 (the knight's *MaxHP* is also increased accordingly).
- Restores the knight's *HP* to *MaxHP*

m) The knights can meet Omega Weapon, a prehistoric monster existed since the universe had been formed. If encountering Omega Weapon, the knight will lose at any level, the knight's *HP* will be reduced to zero and the knight must call the phoenix to continue the journey. Only knight at level 10 who has Excalibur or Dragon Knight at any level with Lionheart can defeat Omega Weapon. In case of defeating Omega Weapon, the knight's level is increased to10 (MaxHP will increase accordingly), the knight's *gil* is increased to 999. After being defeated, Omega Weapon will never reappear (meaning that if the knight meets event codenamed 13 again, the knight simply ignores the event and moves on, in this case, the rose still falls on one petal).

n) Upon meeting Hades, the knight will engage with Hades, the fighting method similar to that described in d. If defeated by Hades, the knight's *HP* will be reduced to zero and must call the phoenix to revive. If Hades was defeated, Hades would forge a *mythril* armor for the knight. Knights wearing mythril armor will never reduce their HP even if they are defeated even when fighting with Hades, Omega Weapon and Ultimecia. However, knights wearing mythril armor can still be poisoned if lost to Tornbery.

Example 7. With the given input as

0 12

```
172 1 0 100
```

14 95 96 97 98 14 6 99 0

The knight will meet Hades and defeat him, so Hades will forge the *mythril* armor for the knight. The knight then picked up all the treasures and pulled out the Excalibur sword. The knight meets Hades for the second time and loses, but because he is wearing Mythril armor, he doesn't have any HP reduction and no need to call the phoenix. Afterwards, the knight meets with Tornbery and loses, so he was poisoned. The knight finally meets Ultimecia and wins, but due to the poison, the knight's HP is still reduced to 57. The *walkthrough* ends, the knight's information is {57,1,0,100}, the report is { 4,2,2}.

If Odin is helping the knight, Hades will kill Odin immediately, from now on, if encountering the event with code 11, Odin will not appear to help the knight, but the rose petals still fall.

Example 8. With the given input as

0 12

```
172 3 0 100
```

11 14 95 96 97 98 11 1 99 0

The knight encounters Odin at event 1, then meets Hades at event 2. Hades immediately kills Odin and fights the knight as usual. Because the knight won against Hades, he will forge a *mythril* armor. After that the knight picked up the treasures, drew the Excalibur sword and met MadBear and lost, but because he was wearing mythril armor, his *HP* was not reduced. In the end, the knight defeated Ultimecia and the *walkthrough* function ended. The knight's information is {172,3,0,100}, the report's information is {3,2,1}.

However, when meeting Hades, if the knight carries with him the power of *Eternal Love*, the power of love will overcome death, Hades will lose regardless of every *levelO* available. Knights have Eternal Love in the following cases:

- Knights have Lancelot's spear and Guinevere's hair but no Excalibur.
- The knight is Arthur and he has Guinevere's hair.
- The knight is Lancelot and he has Guinevere's hair.
- The knight is Guinevere and has Lancelot's spear

o) Scarlet Hakama (SH) is the mysterious costume of the ancient Japanese samurais. If the Scarlet Hakama is picked up, the knight will not lose his *gil* if he loses the Queen of Cards, Nina will not charge for de-poisoning and exchanging HP. If the knight enters Durian Garden when having Scarlet Hakama, the number of rose petals will be increased to 99.

p) LockedDoor Challenge is the place to test the courage of the knights. If meeting LockedDoor at the i^{th} event, the knight will only pass LockedDoor if the knight level is greater than i%10. If the cannot pass the LockedDoor, he must leave the castle and move to the next castle, but the knight's *level* and *MaxHP* will still increase as if leaving the castle in the normal way.

Example 9. With the given input as

0 12

```
172 2 0 100
```

95 16 96 97 98 99 0

At the 1st event, the knight picks up the Paladin's shield, but by the second event, the knight fails to pass the challenge gate and leaves the castle, the knight's level will be increased to 3. Because there is not other castle, the knight went back to the beginning. This time the knight passed the test gate, picked up all the treasures and pulled out the Excalibur sword. In the end, the knight defeated Ultimecia and the *walkthrough* function ended. The knight's information is {172,3,0,100}, the report's information is {4,1,0}.

q) If the knight's initial HP is 999, the knight is in fact King Arthur who reappears to fight with Ultimecia. Arthur can draw the sword Excalibur at any time without having enough three treasures. Arthur defeats all opponents with codes 1-7 at any level. Arthur is not limited in number of rose petals, ie. if the number of rose petals is zero, Arthur continues the journey until victory.

Example 9b. With the given input as

0 1

```
999 2 0 100
```

10 98 99 95 96 97 0

In event 1, Arthur picked up an antidote. Right now the number of rose petals has been over, but Arthur continues the journey, draws the sword Excalibur and defeats Ultimecia. The walkthrough is over. The knight's information is {999,2,1,100}, the report's information is {0,1,0}.

r) If the knight's initial HP is 888, the knight is Lancelot. Lancelot already has his spear by default (treasure with code 96) and only needs to find the remaining two treasures to get Excalibur. Lancelot defeats all opponents with codes 1-7 and passes all challenging gates at any level.

s) If the knight's initial HP is 777, the knight is Princess Guinevere. Guinevere defaulted to having her hair (treasure code 97) and only needed to find the remaining two treasures to get Excalibur. Thanks to her beauty, Guinevere is favored by female opponents. If defeated by MoonBringer and Ultimecia, Guinevere will not be reduced HP, when defeated by Queen of Cards, Guinevere will not reduce *gil*. Nina will not collect money when de-poisoning and exchanging HP for Guinevere but also giving her an additional 50 gil, but Guinevere's *gil* number must not increase more than 999.

t) If the knight's original HP is a prime number, that knight is a Paladin. By default, the Paladin already has his shield (treasure code 95) and only needs to find the remaining two treasures to get Excalibur. Paladins beat all opponents with codes 1-5 at any level. When losing to Tornbery, Paladin was not poisoned. According to an ancient code passed down from ancient times, Nina will not charge money to de-poison and exchange HP for Paladin. If the Paladin has the Lionheart, this sword will remain with Paladin permanently without returning to Nina after 5 events.

u) Among the Knights of the Round Table, there were a number of special knights whose veins were flowed with the dragon blood, called the *Dragon Knights*. A knight is a Dragon Knight if the knight's initial HP is the sum of three positive integers x, y, z such that $x^2 + y^2 = z^2$. Note that if the knight's initial HP is 888, this knight is not a Dragon Knight but Lancelot. Dragon Knights when combined with Odin will defeat Hades (Odin is not killed by Hades in this case and will continue to help the knight for all 5 events). Dragon Knights will not be poisoned if they lose to Tornbery and have the ability to overcome all challenging gates at any level.

v) If the initial *mode* = 1, the knight can only pick up the treasures in the order specified by a *hash* function (see also Section 5 for the *hash* function). Treasures with a smaller hash value must be picked before a treasure with a higher hash value. Different treasures will have different hash values.

Example 10. With the given input as

1 12

```
4 1 0 100
```

95 96 97 98 99 0

Suppose *hash*(95) = 2, *hash*(96) = 1, *hash*(97) = 3. At first the knight meets Paladin's shield, but because Lancelot's spear has not yet been picked up, the knight cannot pick up the shield. Then the knight meets Guinevere's hair and can't pick it up because there's no Paladin's shield. After that the knight could not draw the Excalibur from the stone and is defeated by Ultimecia, the *HP* was reduced to 1. Then the knight left the castle, level = 2, and returned to the beginning. This time the knights took turns collecting the treasures, drawing out Excalibur and defeating Ultimecia. The *walkthrough* function ends. The knight's information is {1,2,0,100}, the report's information is {2,1,1}.

x) (*bonus*) If the initial *mode* = 2, the knight will choose the most optimal path through the castle. The P_1 path is considered to be more optimal than P_2 if the number of rose petals left after following the P_1 path is more than the P_2 path. Test cases will ensure only one optimal path. Durian Garden event will not occur in mode 2.

Example 10. With the given input as

2 12

```
172 4 0 100
```

98 99 0 95 96 97 0

The optimal path would be to pass through castle 2 first and then to castle 1. The knight will follow this path. When the *walkthrough* function ends, the knight's information is {172,5,0,100}, the report information is {7,1,0}.

5. Initialization

Students download the Assigment_2.zip file from the course's Web site. When extracting this file, you will get the following files.

`input.txt`	An input example
`main.cpp`	The main program
`sword.cpp`	The implementation developed by students
`defs.h`	The definition of shared struct and functions
`Assignment_2.pdf`	The assignment description

The *input.txt* file is a sample input file as described in Section 3. The *main.cpp* file is an initialization program, including the following built-in functions:

- *main()*: the main program to be executed
- *readFile()*: function to read input file
- *display()*: function to display data to the screen.
- *callPhoenix()*: students must call this function when calling phoenix to revive knight
- *hash()*: function indicates the hash value of each event. The hash function written in the *main.cpp* file is for reference only. When marking, the hash function can be changed.

Note that students **do not allowed to change *main.cpp* and *defs.h* files when executing the program.**

Students will implement the *walkthrough* function in the sword.cpp file with the following requirements.

- The *walkthrough* function do not output any data to the screen when executing.
- The result returned by the *walkthroug*h function must be a pointer to the report structure generated by the dynamic allocation command (the *new* command).

To compile and execute the program, students place all 3 files *main.cpp, sword.cpp* and *defs.h* in the same directory. Then just compile and execute only the file *main.cpp*. All work to be done will be implemented in the file *sword.cpp*, but there is no need to compile and execute this file.

Example: To compile and execute the program on the Cygwin environment, execute the following commands:

- Run: "g++ main.cpp", the output is: a.out file
- Next run the command: "./a.out input.txt" with "input.txt" is your test case and it is in the same directory with your code.

6. Submission

The deadline for submission is **23:55 on Sunday, June 7th, 2020**. Students must use the account on the BKeL system to submit the work. We DO NOT receive any thing related to assignment which is sent via email or any other form. Late submissions will NOT be accepted.

Besides the libraries already used in *defs.h*, students should NOT use any other library. When submitting the work, students only submit one file: *sword.cpp* (the file name must be in lower case). **Other files will be automatically deleted when marking.** The file to

be submitted must be in the plain format, students must not compress the file when submitting. **Students must check their program on Cygwin before submitting.**

7. Plagiarism

Students must do the assignment themselves. Their works will be considered plagiarism if:

- There is large similarity between the source code of submissions. In this case, all submissions are considered plagiarism. Therefore, students must protect the source code.
- Students do not understand the source code written by themselves, except for the parts of code provided in the initialization program. Students can consult from any source, but make sure that they understand the meaning of all the code they write.

In the case of a conclusion of cheating, students will receive a zero for the entire subject (not just the assignment).

DO NOT ACCEPT ANY EXCUSE AND NO EXCEPTIONS!

After each assignment is submitted, there will be a number of students who are randomly interviewed to prove that the assignment has been submitted by themselves.