Question #: 1

Zombie Island Apocalypse (Part B)

--- Description is the same as Part A ---

Just when you thought that the world was recovering from COVID-19, a new zombie apocalypse has broken out on a desert island.

The outbreak starts on **day 0** with one infected person (zombie). The rate of the zombie infection is modelled by a parameter r_0. On each new day, the zombies will infect an additional r_0 times the existing zombie population, rounded up. You may assume the function `ceil` is available to round up.

For example,

with r_0=0.5, the sequence of zombie population is 1, 2, 3, 5, 8, 12, 18, 27, 41, 62, 93, ...

with r_0=1.0, the sequence of zombie population is 1, 2, 4, 8, 16, 32, 64, 128, 256, 512, 1024, ...

with r_0=2.0, the sequence of zombie population is 1, 3, 9, 27, 81, 243, 729, 2187, 6561, 19683, ...

--- Description duplicated above for your convienence ---

Question: Implement an **RECURSIVE** function `zombie(r0, day)` that takes as input an r_0 value and a day. It returns the number of zombies on the island on the given day. E.g., `zombie(0.5, 6)` returns 18.

Note: The function should be purely recursive, i.e. no loops or using any helper function.

[5 marks]

Item ID: 212952 / 3
Item Description: Zombie B (Python)
Item Weight: 5.0
Item Creator: dcsleong@nus.edu.sg
Item Psychometrics:

No item psychometrics are available at this time, this item has yet to be scored in any assessment.

Question #: 2

Zombie Island Apocalypse (Part B)

--- Description is the same as Part A ---

Just when you thought that the world was recovering from COVID-19, a new zombie apocalypse has broken out on a desert island.

The outbreak starts on **day 0** with one infected person (zombie). The rate of the zombie infection is modelled by a parameter r_0. On each new day, the zombies will infect an additional r_0 times the existing zombie population, rounded up. You may assume the function `int ceil(double)` is available to round up.

For example,

with r_0=0.5, the sequence of zombie population is 1, 2, 3, 5, 8, 12, 18, 27, 41, 62, 93, ...

with r_0=1.0, the sequence of zombie population is 1, 2, 4, 8, 16, 32, 64, 128, 256, 512, 1024, ...

with r_0=2.0, the sequence of zombie population is 1, 3, 9, 27, 81, 243, 729, 2187, 6561, 19683, ...

--- Description duplicated above for your convienence ---

Question: Implement an **RECURSIVE** function `int zombie(double r0, int day)` that takes as input an r_0 value and a day. It returns the number of zombies on the island on the given day. E.g., `zombie(0.5, 6)` returns 18.

Note: The function should be purely recursive, i.e. no loops or using any helper function.

[5 marks]

Item ID: 212951 / 3
Item Description: Zombie B (C/Java)
Item Weight: 5.0
Item Creator: dcsleong@nus.edu.sg
Item Psychometrics:

No item psychometrics are available at this time, this item has yet to be scored in any assessment.

Question #: 3

Zombie Island Apocalypse (Part A)

Just when you thought that the world was recovering from COVID-19, a new zombie apocalypse has broken out on a desert island.

The outbreak starts on **day 0** with one infected person (zombie). The rate of the zombie infection is modelled by a parameter r_0. On each new day, the zombies will infect an additional r_0 times the existing zombie population, rounded up. You may assume the function `ceil` is available to round up.

For example,

with r_0=0.5, the sequence of zombie population is 1, 2, 3, 5, 8, 12, 18, 27, 41, 62, 93, ...

with r_0=1.0, the sequence of zombie population is 1, 2, 4, 8, 16, 32, 64, 128, 256, 512, 1024, ...

with r_0=2.0, the sequence of zombie population is 1, 3, 9, 27, 81, 243, 729, 2187, 6561, 19683, ...

Question: Implement an **ITERATIVE** function `zombie(r0, day)` that takes as input an r_0 value and a day. It returns the number of zombies on the island on the given day. E.g., `zombie(0.5, 6)` returns 18.

[5 marks]

Item ID: 212931 / 3
Item Description: Zombie A (Python)
Item Weight: 5.0
Item Creator: dcsleong@nus.edu.sg
Item Psychometrics:

> No item psychometrics are available at this time, this item has yet to be scored in any assessment.

Question #: 4

Zombie Island Apocalypse (Part A)

Just when you thought that the world was recovering from COVID-19, a new zombie apocalypse has broken out on a desert island.

The outbreak starts on **day 0** with one infected person (zombie). The rate of the zombie infection is modelled by a parameter r_0. On each new day, the zombies will infect an additional r_0 times the existing zombie population, rounded up. You may assume the

function `int ceil(double)` is available to round up.

For example,

with r_0=0.5, the sequence of zombie population is 1, 2, 3, 5, 8, 12, 18, 27, 41, 62, 93, ...

with r_0=1.0, the sequence of zombie population is 1, 2, 4, 8, 16, 32, 64, 128, 256, 512, 1024, ...

with r_0=2.0, the sequence of zombie population is 1, 3, 9, 27, 81, 243, 729, 2187, 6561, 19683, ...

Question: Implement an **ITERATIVE** function `int zombie(double r0, int day)` that takes as input an r_0 value and a day. It returns the number of zombies on the island on the given day. E.g., `zombie(0.5, 6)` returns 18.

[5 marks]

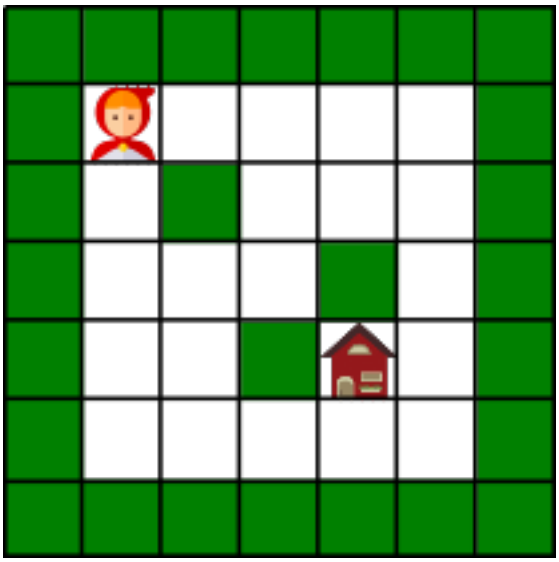
Item ID: 212927 / 4
Item Description: Zombie A (C/Java)
Item Weight: 5.0
Item Creator: dcsleong@nus.edu.sg
Item Psychometrics:

No item psychometrics are available at this time, this item has yet to be scored in any assessment.

Question #: 5

Little Red Riding Hood (Part B)

Suppose Little Red Riding Hood can now travel in all four **up**, **down**, **left** and **right** directions.



Given the same forest grid, she can now find a path to Grandma's house.

Question: Implement the same function `can_reach` from part A, given that Little Red Riding Hood can now travel in all four directions.

[10 marks]

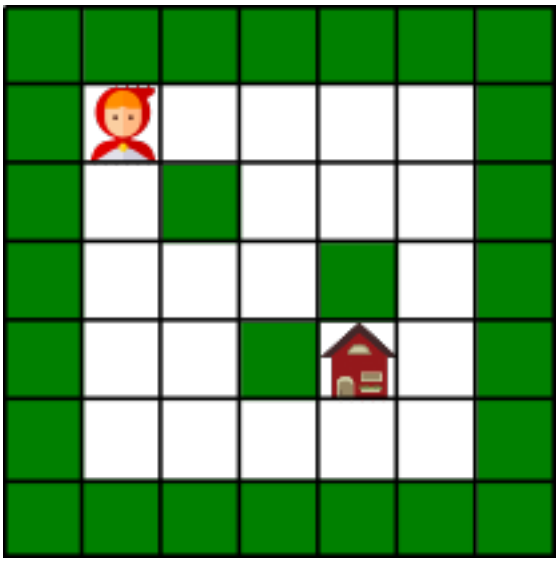
Item ID: 213122 / 4
Item Description: Red Riding Hood B (C/Java/Python)
Item Weight: 10.0
Item Creator: dcsleong@nus.edu.sg
Item Psychometrics:

> No item psychometrics are available at this time, this item has yet to be scored in any assessment.

Question #: 6

Little Red Riding Hood (Part A)

Little Red Riding Hood is in a forest and needs to travel to Grandma's house. The forest is laid out as a grid with some positions inaccessible being blocked by trees. An example is illustrated below:



The topmost-leftmost grid is row 0, col 0 and green squares are the inaccessible positions. Suppose Little Red Riding Hood can only travel between adjacent grid positions in the **down** and **right** direction, i.e. in increasing grid positions. If she start at row 1, col 1, and Grandma's house is at row 4, col 4 as shown, she will never be able to reach Grandma's house. But if Grandma's house is at row 5, col 5, then there exists a path for her to reach Grandma's house.

Question: The forest grid is represented in Python as a list-of-list of integers in **row-major order**. Accessible cells have the value 1 and inaccessible cells have the value 0. Assume that Little Red Riding Hood always starts at row 1, col 1, and that the border of the forest is always inaccessible.
Implement a function `can_reach(forest, row, col)` that takes as input the forest maze, and the row and column of Grandma's house. The function returns True if there exists a path to Grandma's house, and False if no path is possible.

[5 marks]

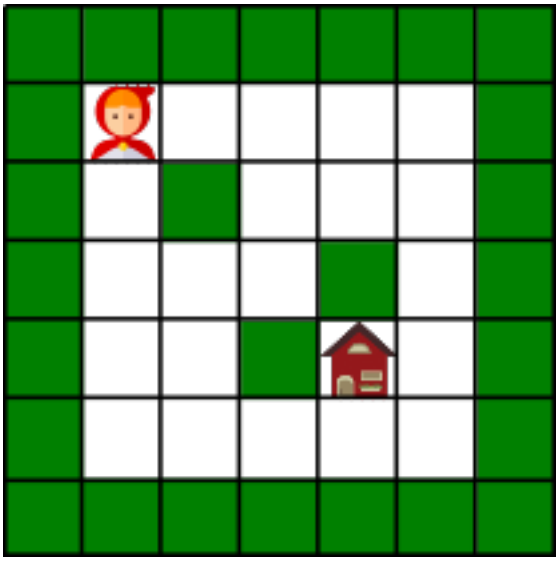
Item ID: 213061 / 2
Item Description: Red Riding Hood A (Python)
Item Weight: 5.0
Item Creator: dcsleong@nus.edu.sg
Item Psychometrics:

No item psychometrics are available at this time, this item has yet to be scored in any assessment.

Question #: 7

Little Red Riding Hood (Part A)

Little Red Riding Hood is in a forest and needs to travel to Grandma's house. The forest is laid out as a grid with some positions inaccessible being blocked by trees. An example is illustrated below:



The topmost-leftmost grid is row 0, col 0 and green squares are the inaccessible positions. Suppose Little Red Riding Hood can only travel between adjacent grid positions in the **down** and **right** direction, i.e. in increasing grid positions. If she start at row 1, col 1, and Grandma's house is at row 4, col 4 as shown, she will never be able to reach Grandma's house. But if Grandma's house is at row 5, col 5, then there exists a path for her to reach Grandma's house.

Question: The forest grid is represented in Java as a 2D array of integers in **row-major order**. Accessible cells have the value 1 and inaccessible cells have the value 0. Assume that Little Red Riding Hood always starts at row 1, col 1, and that the border of the forest is always inaccessible.

Implement a function `boolean can_reach(int[][] forest, int row, int col)` that takes as input the forest maze, and the row and column of Grandma's house. The function returns true if there exists a path to Grandma's house, and false if no path is possible.

[5 marks]

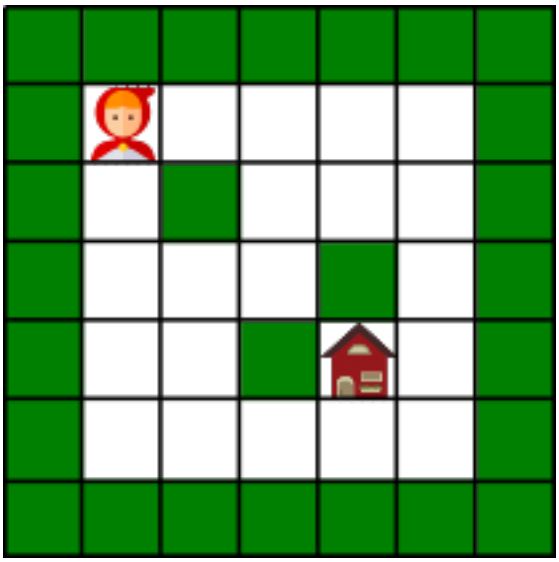
Item ID: 213059 / 3
Item Description: Red Riding Hood A (Java)
Item Weight: 5.0
Item Creator: dcsleong@nus.edu.sg
Item Psychometrics:

No item psychometrics are available at this time, this item has yet to be scored in any assessment.

Question #: 8

Little Red Riding Hood (Part A)

Little Red Riding Hood is in a forest and needs to travel to Grandma's house. The forest is laid out as a grid with some positions inaccessible being blocked by trees. An example is illustrated below:



The topmost-leftmost grid is row 0, col 0 and green squares are the inaccessible positions. Suppose Little Red Riding Hood can only travel between adjacent grid positions in the **down** and **right** direction, i.e. in increasing grid positions. If she start at row 1, col 1, and Grandma's house is at row 4, col 4 as shown, she will never be able to reach Grandma's house. But if Grandma's house is at row 5, col 5, then there exists a path for her to reach Grandma's house.

Question: The forest grid is represented in C as a 2D array of integers in **row-major order**. Accessible cells have the value 1 and inaccessible cells have the value 0. Assume that Little Red Riding Hood always starts at row 1, col 1, and that the border of the forest is always inaccessible.

Implement a function `bool can_reach(int forest[N][M], int row, int col)` that takes as input the forest maze of N rows and M columns, and the row and column of Grandma's house. The function returns true if there exists a path to Grandma's house, and false if no path is possible.

[5 marks]

Item ID: 213051 / 2
Item Description: Red Riding Hood A (C)
Item Weight: 5.0
Item Creator: dcsleong@nus.edu.sg
Item Psychometrics:

No item psychometrics are available at this time, this item has yet to be scored in any assessment.

Question #: 9

Nine Pin Bowling (Part C)

To reward players who manage to hit all nine pins in a bowl, the number of pins felled in the next bowl will be added to the score. The most significant (left-most) digit of the game is the first bowl.

For example, the game 4927 will be 4 +9 +2 +2 +7 =24, as the score for the second bowl is 9 +2.

The score for a perfect game of ten bowl (9999999999) will be 171, because each bowl except for the last bowl is worth 9 +9 =18 points. (9 +9) × 9 +9 =171.

The score for the game 49090 is 4 +9 +9 =22 because after knocking down nine pins in a bowl, the player did not knock down any in the next bowl.

Question: Implement the function `score(game)` which takes in a game, and returns the score of the game using this scoring system.

Note: You are NOT allowed to convert the game to a string and use Python string functions.

[5 marks]

Item ID: 212925 / 2
Item Description: Nine Pin Bowling C (Python)
Item Weight: 5.0
Item Creator: dcsleong@nus.edu.sg
Item Psychometrics:

> No item psychometrics are available at this time, this item has yet to be scored in any assessment.

Question #: 10

Nine Pin Bowling (Part C)

To reward players who manage to hit all nine pins in a bowl, the number of pins felled in the next bowl will be added to the score. The most significant (left-most) digit of the game is the first bowl.

For example, the game 4927 will be 4 +9 +2 +2 +7 =24, as the score for the second bowl is 9 +2.

The score for a perfect game of ten bowl (9999999999) will be 171, because each bowl except for the last bowl is worth 9 +9 =18 points. (9 +9) × 9 +9 =171.

The score for the game 49090 is 4 +9 +9 =22 because after knocking down nine pins in a bowl, the player did not knock down any in the next bowl.

Question: Implement the function `int score(long game)` which takes in a game, and returns the score of the game using this scoring system.

Note: You may assume that the range of the long type is sufficiently large for all inputs, and you are NOT allowed to convert the game to a string and use string functions.

[5 marks]

Item ID: 212923 / 3
Item Description: Nine Pin Bowling C (C/Java)
Item Weight: 5.0
Item Creator: dcsleong@nus.edu.sg
Item Psychometrics:

No item psychometrics are available at this time, this item has yet to be scored in any assessment.

Question #: 11

Nine Pin Bowling (Part B)

Knocking down all nine pins in a bowl is called a strike. Bowling consecutive strikes (one after another) is an achievement.

Question: Implement the function `consec_strikes(long)` which takes in a game, and returns the highest number of consecutive strikes in the game.

Note: You are NOT allowed to convert the game to a string and use Python string functions.

[5 marks]

Item ID: 212922 / 2
Item Description: Nine Pin Bowling B (Python)
Item Weight: 5.0
Item Creator: dcsleong@nus.edu.sg
Item Psychometrics:

No item psychometrics are available at this time, this item has yet to be scored in any assessment.

Question #: 12

Nine Pin Bowling (Part B)

Knocking down all nine pins in a bowl is called a strike. Bowling consecutive strikes (one after another) is an achievement.

Question: Implement the function `int consec_strikes(long game)` which takes in a game, and returns the highest number of consecutive strikes in the game.

Note: You may assume that the range of the long type is sufficiently large for all inputs, and you are NOT allowed to convert the game to a string and use string functions.

[5 marks]

Item ID: 212919 / 3
Item Description: Nine Pin Bowling B (C/Java)
Item Weight: 5.0
Item Creator: dcsleong@nus.edu.sg
Item Psychometrics:

> No item psychometrics are available at this time, this item has yet to be scored in any assessment.

Question #: 13

Nine Pin Bowling (Part A)

Nine-pins bowling is a game where a player rolls a ball to strike at nine bowling pins. In our version of nine-pin bowling, players only have one chance to knock down nine pins before they are reset after every bowl. (This is different from the commonly played ten-pin bowling where players get two tries to knock down ten pins.)

A game of nine-pins can thus be represented as an integer, with each digit indicating the number of pins knocked down in a bowl.

For example, a player with a game of 5 bowls where he knocks down 4 pins in his first bowl, and one more pin every subsequent bowl would be represented by the integer 45678. A player scoring a perfect game of 10 bowls would be 9999999999.

Question: Suppose that the raw score of a game is simply the total number of pins felled. Implement the function `pins_felled(game)` that takes as input a game and returns

the total number of pins knocked down in a game.
Note: You are NOT allowed to convert the game to a string and use Python string functions.

[5 marks]

Item ID: 212918 / 2
Item Description: Nine Pin Bowling A (Python)
Item Weight: 5.0
Item Creator: dcsleong@nus.edu.sg
Item Psychometrics:

> No item psychometrics are available at this time, this item has yet to be scored in any assessment.

Question #: 14

Nine Pin Bowling (Part A)

Nine-pins bowling is a game where a player rolls a ball to strike at nine bowling pins. In our version of nine-pin bowling, players only have one chance to knock down nine pins before they are reset after every bowl. (This is different from the commonly played ten-pin bowling where players get two tries to knock down ten pins.)
A game of nine-pins can thus be represented as an integer, with each digit indicating the number of pins knocked down in a bowl.
For example, a player with a game of 5 bowls where he knocks down 4 pins in his first bowl, and one more pin every subsequent bowl would be represented by the integer 45678. A player scoring a perfect game of 10 bowls would be 9999999999.
Question: Suppose that the raw score of a game is simply the total number of pins felled. Implement the function `int pins_felled(long game)` that takes as input a game and returns the total number of pins knocked down in a game.
Note: You may assume that the range of the long type is sufficiently large for all inputs, and you are NOT allowed to convert the game to a string and use string functions.

[5 marks]

Item ID: 212912 / 4
Item Description: Nine Pin Bowling A (C/Java)
Item Weight: 5.0
Item Creator: dcsleong@nus.edu.sg
Item Psychometrics:

No item psychometrics are available at this time, this item has yet to be scored in any assessment.

Question #: 15

Knights, Kanves and Spies (Part E)

A very special island is inhabited only by knights, knaves and spies. Knights always tell the truth, knaves always lie, and spies either tell the truth or lie.

You meet three inhabitants X, Y and Z. You know that one of them is a knight, one is a knave, and one is a spy.

X says, "Z is the spy."

Y says, "X is the knave."

Z says, "You can identify the knight based only on what X and Y said."

X is a **1**

Y is a **2**

Z is a 3

[3 marks]

1. choice of: Knight|Knave|Spy
2. choice of: Knight|Knave|Spy
3. choice of: Knight|Knave|Spy

Item ID: 213044 / 3
Item Description: Knights and Knaves E
Item Weight: 3.0
Item Creator: dcsleong@nus.edu.sg
Item Psychometrics:

Difficulty Level/P-value	Upper 27%	Lower 27%	Discrimination Index	Point Biserial(Question)	Point Biserial(Rev)
0.95	-	-	-	0.43	0.43

Question #: 16

Knights, Kanves and Spies (Part D)

A very special island is inhabited only by knights, knaves and spies. Knights always tell the truth, knaves always lie, and spies either tell the truth or lie.

You meet three inhabitants P, Q and R. You know that one of them is a knight, one is a knave, and one is a spy.

P says, "R is the knave."

Q says, "P is the knight."

R says, "I am the spy."

P is a **1**

Q is a **2**

R is a 3

[3 marks]

1. choice of: Knight|Knave|Spy
2. choice of: Knight|Knave|Spy
3. choice of: Knight|Knave|Spy

Item ID: 213043 / 3
Item Description: Knights and Knaves D
Item Weight: 3.0
Item Creator: dcsleong@nus.edu.sg
Item Psychometrics:

Difficulty Level/P-value	Upper 27%	Lower 27%	Discrimination Index	Point Biserial(Question)	Point Biserial(Rev)
0.98	-	-	-	0.15	0.15

Question #: 17

Knights and Kanves (Part C)

A very special island is inhabited only by knights and knaves. Knights always tell the truth, and knaves always lie.

You meet three inhabitants E, F and G.

E says, "G is not a knave."

F says, "Either G is a knight, or I am a knight."

G says, "F is a knave."

E is a **1**

F is a **2**

G is a 3

[3 marks]

1. choice of: Knight|Knave
2. choice of: Knight|Knave
3. choice of: Knight|Knave

Item ID: 213042 / 3
Item Description: Knights and Knaves C
Item Weight: 3.0
Item Creator: dcsleong@nus.edu.sg
Item Psychometrics:

Difficulty Level/P-value	Upper 27%	Lower 27%	Discrimination Index	Point Biserial(Question)	Point Biserial(Rev)
0.84	-	-	-	0.46	0.46

Question #: 18

Knights and Kanves (Part B)

A very special island is inhabited only by knights and knaves. Knights always tell the truth, and knaves always lie.

You meet two inhabitants C and D.

C says, "We are both not the same."

D says, "Exactly one of us is a knight."

C is a **1**

D is a **2**

[3 marks]

1. choice of: Knight|Knave
2. choice of: Knight|Knave

Item ID: 213041 / 3
Item Description: Knights and Knaves B
Item Weight: 3.0
Item Creator: dcsleong@nus.edu.sg
Item Psychometrics:

Difficulty Level/P-value	Upper 27%	Lower 27%	Discrimination Index	Point Biserial(Question)	Point Biserial(Rev)
0.88	-	-	-	0.70	0.70

Question #: 19

Knights and Kanves (Part A)

A very special island is inhabited only by knights and knaves. Knights always tell the truth, and knaves always lie.

You meet two inhabitants A and B.

A says, "B is a knave".

B says, "Neither of us are knaves."

A is a 1

B is a 2

[3 marks]

1. choice of: Knight|Knave
2. choice of: Knight|Knave

Item ID: 213040 / 3
Item Description: Knights and Knaves A
Item Weight: 3.0
Item Creator: dcsleong@nus.edu.sg
Item Psychometrics:

Difficulty Level/P-value	Upper 27%	Lower 27%	Discrimination Index	Point Biserial(Question)	Point Biserial(Rev)
0.96	-	-	-	0.37	0.37

Question #: 20

Range of Integers (Part C)

A set of integers can be represented as a minimal set of ranges, one where no two ranges can be merged.

When a range is added to a minimal set of ranges, the result can still be represeted as a minimal set of ranges. For example, adding the range [3-4] to a minimal set {[1-2], [4-6], [8-10]} will result in the minimal set {[1-6], [8-10]}.

Question: Implement a function `add(range, lst)` that takes as input a range and a list which represents the minimal set of ranges. The function merges the new range into the set of ranges to get a minimal set of ranges and prints a list of all the ranges in this new minimal set of ranges. Assume the function `print(range)` will print the range as desired.

For example, adding the range [3-5] to a minimal set {[1-2], [4-6], [8-10]} will result in following ranges printed:

[1-6]
[8-10]

[5 marks]

Item ID: 213036 / 2
Item Description: Interval C (Python)
Item Weight: 5.0
Item Creator: dcsleong@nus.edu.sg
Item Psychometrics:

No item psychometrics are available at this time, this item has yet to be scored in any assessment.

Question #: 21

Range of Integers (Part C)

A set of integers can be represented as a minimal set of ranges, one where no two ranges can be merged.

When a range is added to a minimal set of ranges, the result can still be represeted as a minimal set of ranges. For example, adding the range [3-4] to a minimal set {[1-2], [4-6], [8-10]} will result in the minimal set {[1-6], [8-10]}.

Question: Implement a function `void add(Range r, Range[] s)` that takes as input a range and an array which represents the minimal set of ranges. The function merges the new range into the set of ranges to get a minimal set of ranges and prints a list of all the ranges in this new minimal set of ranges. A function `print(Range)` that prints a range is given.

For example, adding the range [3-5] to a minimal set {[1-2], [4-6], [8-10]} will result in following ranges printed:

[1-6]
[8-10]

[5 marks]

Item ID: 213035 / 2
Item Description: Interval C (Java)
Item Weight: 5.0
Item Creator: dcsleong@nus.edu.sg
Item Psychometrics:

No item psychometrics are available at this time, this item has yet to be scored in any assessment.

Question #: 22

Range of Integers (Part C)

A set of integers can be represented as a minimal set of ranges, one where no two ranges can be merged.

When a range is added to a minimal set of ranges, the result can still be represeted as a minimal set of ranges. For example, adding the range [3-4] to a minimal set {[1-2], [4-6], [8-10]} will result in the minimal set {[1-6], [8-10]}.

Question: Implement a function `void add(Range r, Range s[], int n)` that takes as input a range and an array of size n, which represents the minimal set of ranges. The function merges the new range into the set of ranges to get a minimal set of ranges and prints a list of all the ranges in this new minimal set of ranges. A function `print(Range)` that prints a range is given.

For example, adding the range [3-5] to a minimal set {[1-2], [4-6], [8-10]} will result in following ranges printed:

[1-6]
[8-10]

[5 marks]

Item ID: 212958 / 2
Item Description: Interval C (C)
Item Weight: 5.0
Item Creator: dcsleong@nus.edu.sg
Item Psychometrics:

No item psychometrics are available at this time, this item has yet to be scored in any assessment.

Question #: 23

Range of Integers (Part B)

Question: Implement a function `merge(a, b)` that takes as input two ranges that can be merged and returns the merged range.
You can assume the inputs are always valid and do not need to handle invalid inputs.

[5 marks]

Item ID: 212960 / 2
Item Description: Interval B (Python)
Item Weight: 5.0
Item Creator: dcsleong@nus.edu.sg
Item Psychometrics:

> No item psychometrics are available at this time, this item has yet to be scored in any assessment.

Question #: 24

Range of Integers (Part B)

Question: Implement a function `Range merge(Range a, Range b)` that takes as input two ranges that can be merged and returns the merged range.
You can assume the inputs are always valid and do not need to handle invalid inputs.

[5 marks]

Item ID: 212956 / 2
Item Description: Interval B (C/Java)
Item Weight: 5.0
Item Creator: dcsleong@nus.edu.sg
Item Psychometrics:

No item psychometrics are available at this time, this item has yet to be scored in any assessment.

Question #: 25

Range of Integers (Part A)

A set of consecutive integers can be represented as a range using two integers: the smallest and largest integer in the set. We can write them as ranges like [1-5], [7-8] or even [6-6]

A range is represented in Python as a tuple of two integers `(a, b)`, where a ? b.
If the union of two ranges contains consecutive integers, then it is also a range. We say the ranges can be *merged* together to a range. For example, the ranges [1-3] and [4-6] can be merged to [1-6].

Question: Implement a function `can_merge(a, b)` that takes as input two ranges, and returns True if the two ranges can be merged, and False otherwise.

[5 marks]

Item ID: 212961 / 2
Item Description: Interval A (Python)
Item Weight: 5.0
Item Creator: dcsleong@nus.edu.sg
Item Psychometrics:

No item psychometrics are available at this time, this item has yet to be scored in any assessment.

Question #: 26

Range of Integers (Part A)

A set of consecutive integers can be represented as a range using two integers: the smallest and largest integer in the set. We can write them as ranges like [1-5], [7-8] or even [6-6]

A range is represented in Java as the following class, where a ? b:

```
class Range {
   public int a;
```

```
    public int b;
}
```

If the union of two ranges contains consecutive integers, then it is also a range. We say the ranges can be *merged* together to a range. For example, the ranges [1-3] and [4-6] can be merged to [1-6].

Question: Implement a function `boolean can_merge(Range a, Range b)` that takes as input two ranges, and returns true if the two ranges can be merged, and false otherwise.

[5 marks]

Item ID: 212959 / 3
Item Description: Interval A (Java)
Item Weight: 5.0
Item Creator: dcsleong@nus.edu.sg
Item Psychometrics:

No item psychometrics are available at this time, this item has yet to be scored in any assessment.

Question #: 27

Range of Integers (Part A)

A set of consecutive integers can be represented as a range using two integers: the smallest and largest integer in the set. We can write them as ranges like [1-5], [7-8] or even [6-6]

A range is represented in C as the following type, where a ? b:

```
typedef struct Range {
    int a;
    int b;
} Range;
```

If the union of two ranges contains consecutive integers, then it is also a range. We say the ranges can be *merged* together to a range. For example, the ranges [1-3] and [4-6] can be merged to [1-6].

Question: Implement a function `bool can_merge(Range a, Range b)` that takes as input two ranges, and returns true if the two ranges can be merged, and false otherwise.

[5 marks]

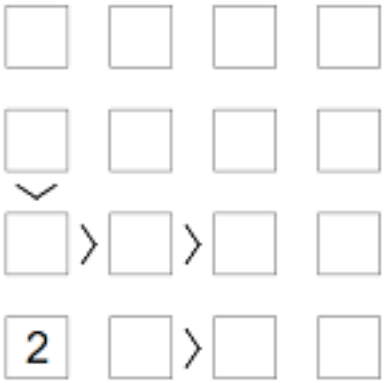
Item ID: 212953 / 6
Item Description: Interval A (C)
Item Weight: 5.0
Item Creator: dcsleong@nus.edu.sg
Item Psychometrics:

No item psychometrics are available at this time, this item has yet to be scored in any assessment.

Question #: 28

Futoshiki

Futoshiki (???, *fut?shiki*), or ***More or Less***, is a logic puzzle game from Japan. Its name means "inequality".
The puzzle is played on an n × n square grid. The objective is to place the numbers 1 to n, such that **each row** and **column** contains only **one of each number**. Some numbers may be given at the start. Inequality constraints may also be specified between some of the squares, such that one must be higher or lower than its neighbor. These constraints must be honoured in order to complete the puzzle.
Provide the solution for the following Futoshiki puzzle:



Give your answer in "matrix" form, e.g.:
1 2 3 4
2 3 4 1
3 4 1 2

4 1 2 3

[5 marks]

Item ID: 213045 / 2
Item Description: Futoshiki
Item Weight: 5.0
Item Creator: dcsleong@nus.edu.sg
Item Psychometrics:

> No item psychometrics are available at this time, this item has yet to be scored in any assessment.

Question #: 29

Code Comprehension Part C

Consider the following function:

```
def bar(lst):
    i, j =0, 0
    while (j <len(lst)):
        if (lst[j] % 2):
            lst[i], lst[j] =lst[j], lst[i]
            i +=1
        j +=1
```

Assuming that the input is a List of integers, briefly describe (in fewer than 10 words) the behaviour of the function bar.

[5 marks]

Item ID: 212908 / 2
Item Description: Code Comprehension C (Python)
Item Weight: 5.0
Item Creator: dcsleong@nus.edu.sg
Item Psychometrics:

No item psychometrics are available at this time, this item has yet to be scored in any assessment.

Question #: 30

Code Comprehension Part C

Consider the following function:

```
void bar(int[] arr) {
    int i =0, j =0, t;
    while (j <arr.length) {
        if (arr[j] % 2 ==1) {
            t =arr[i];
            arr[i] =arr[j];
            arr[j] =t;
            i +=1;
        }
        j +=1;
    }
}
```

Assuming that the input is an array, briefly describe (in fewer than 10 words) the behaviour of the function bar.

[5 marks]

Item ID: 212907 / 2
Item Description: Code Comprehension C (Java)
Item Weight: 5.0
Item Creator: dcsleong@nus.edu.sg
Item Psychometrics:

No item psychometrics are available at this time, this item has yet to be scored in any assessment.

Question #: 31

Code Comprehension Part C

Consider the following function:

```
void bar(int arr[], int n) {
    int i =0, j =0, t;
    while (j <n) {
        if (arr[j] % 2) {
            t =arr[i];
            arr[i] =arr[j];
            arr[j] =t;
            i +=1;
        }
        j +=1;
    }
}
```

Assuming that the input is an array of size n, briefly describe (in fewer than 10 words) the behaviour of the function bar.

[5 marks]

Item ID: 212906 / 2
Item Description: Code Comprehension C (C)
Item Weight: 5.0
Item Creator: dcsleong@nus.edu.sg
Item Psychometrics:

No item psychometrics are available at this time, this item has yet to be scored in any assessment.

Question #: 32

Code Comprehension Part B

Consider the following function:

```
def boo(p, q):
    s =0
    while (p >0):
        s +=1
        if (s ==q):
            s =0
```

```
    p -= 1
    return s
```

Assuming that both inputs are positive integers, briefly describe (in fewer than 10 words) the behaviour of the function boo.

[5 marks]

Item ID: 212903 / 4
Item Description: Code Comprehension B (Python)
Item Weight: 5.0
Item Creator: dcsleong@nus.edu.sg
Item Psychometrics:

No item psychometrics are available at this time, this item has yet to be scored in any assessment.

Question #: 33

Code Comprehension Part B

Consider the following function:

```
int boo(int p, int q) {
    int s =0;
    while (p >0) {
        s +=1;
        if (s ==q) {
            s =0;
        }
        p -= 1;
    }
    return s;
}
```

Assuming that both inputs are positive integers, briefly describe (in fewer than 10 words) the behaviour of the function boo.

[5 marks]

Item ID: 212904 / 3
Item Description: Code Comprehension B (C/Java)
Item Weight: 5.0
Item Creator: dcsleong@nus.edu.sg
Item Psychometrics:

No item psychometrics are available at this time, this item has yet to be scored in any assessment.

Question #: 34

Code Comprehension Part A

Consider the following function:

```
def foo(a, b):
  if (b ==0):
    return a
  else:
    return foo(a +1, b - 1)
```

Assuming that both inputs are non-negative integers, briefly describe (in fewer than 10 words) the behaviour of the function foo.

[5 marks]

Item ID: 212901 / 3
Item Description: Code Comprehension A (Python)
Item Weight: 5.0
Item Creator: dcsleong@nus.edu.sg
Item Psychometrics:

No item psychometrics are available at this time, this item has yet to be scored in any assessment.

Question #: 35

Code Comprehension Part A

Consider the following function:

```
int foo(int a, int b) {
    if (b ==0)
        return a;
    else
        return foo(a +1, b - 1);
}
```

Assuming that both inputs are non-negative integers, briefly describe (in fewer than 10 words) the behaviour of the function foo.

[5 marks]

Item ID: 212898 / 4
Item Description: Code Comprehension A (C/Java)
Item Weight: 5.0
Item Creator: dcsleong@nus.edu.sg
Item Psychometrics:

No item psychometrics are available at this time, this item has yet to be scored in any assessment.
