Tutorial 5 STQD6214

1. Write down a function named `vector_mean` that calculates the mean of a vector. Compare your result with the function `mean`.

2. The `%%` operator calculates the remainder when a number is divided by another number. For example, `3 %% 2` will return `1` while `4 %% 2` will return `0`. Another name for this operation is the modulus operation where 3 mod 2 = 1.

   Using this operator, write down a function that takes input two integer values, *a* and *b*, and determine whether *a* is a multiple of *b*. The function will return `TRUE` if *a* is a multiple of *b*, and will return `FALSE` if *a* is not a multiple of *b*. Note that if *a* is a multiple of *b*, then *a* mod *b* = 0.

3. Write a function that takes an input and calculate the square root of this input. The function should return two values, the solution and error check.
   - If the input is not numerical or negative value, return `NA` as the solution, and error check is `TRUE`.
   - Otherwise, return the square root of the input as the solution, and error check is `FALSE`.

   Note: remember to use `list()` to return multiple outputs.

4. Use the `while` loop to determine the number of terms required for the product $1 \times 2 \times 3 \times 4 \times \cdots$ reaches above 10 million.

5. The Fibonacci numbers, denoted as F_n, is a sequence of numbers that starts with $F_1 = 1$ and followed by the second number $F_2 = 1$. For $n \geq 3$, it is given that $F_n = F_{n-1} + F_{n-2}$. Write down a function that will take input *n* and return the first *n* numbers of the Fibonacci numbers.

6. Write a code using `for` loop that simulates the result of a die throw and calculates the sum of the numbers from 10 die throws. Note that the function `sample` can be used to randomly select a value out of the given input. For example `sample(1:6, 1)` will randomly select an integer between 1 to 6 with equal probability.

7. The solutions to the quadratic equation $ax^2 + bx + c = 0$, when they exist, is given as

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Note that there is only one solution if $b^2 - 4ac = 0$ and the solution does not exist if $b^2 - 4ac < 0$.

Write down a function that:

- Takes input the values of a, b, and c.
- Check the number of solutions (0, 1, or 2).
- Calculates the solution to the quadratic equation.
- Returns two outputs: the solutions and the number of solutions.
    - If there is no solution, return NA as the solution, and 0 as the number of solutions.
    - If there is one solution, return the solution, and 1 as the number of solutions.
    - If there are two solutions, return the solutions in vector form, and 2 as the number of solutions.

8. You bought some stocks at a price of RM 1.00 per share. You decided to either cut your loss by selling the shares if the price goes to RM 0.75, or sell the shares for some profit if the price reaches RM 1.50. Assume that each day, the stock price may either decrease by 5 cents, stay the same, or increase by 5 cents, with equal probability.

Write a code that simulates your stock price each day and determine how long it takes for the stock price to either reach RM 0.75 or RM 1.50. You can use `sample(c(-0.05, 0, 0.05), 1)` to select a number between -0.05, 0, and 0.05 with equal probability.