The University of British Columbia

Irving K. Barber School of Arts and Sciences

DATA 101 Term 1 2020W1

Lab 1

Date: Sep 14 - Sep 18

Demonstration. The TA will go through the following example, from the course textbook, with you.

> An individual wishes to take out a loan, today, of P at a monthly interest rate i. The loan is to be paid back in n monthly installments of size R, beginning one month from now. The problem is to calculate R.
>
> Equating the present value P to the future (discounted) value of the n monthly payments R, we have
>
> $$P = R(1+i)^{-1} + R(1+i)^{-2} + \cdots R(1+i)^{-n}$$
>
> or
>
> $$P = R\sum_{j=1}^{n}(1+i)^{-j}.$$
>
> Summing this geometric series and simplifying, we obtain
>
> $$P = R\left(\frac{1-(1+i)^{-n}}{i}\right).$$
>
> This is the formula for the present value of an annuity. We can find R, given P, n and i as
>
> $$R = P\frac{i}{1-(1+i)^{-n}}.$$
>
> In R, we define variables as follows: `principal` to hold the value of P, and `intRate` to hold the interest rate, and `n` to hold the number of payments. We will assign the resulting payment value to an object called `payment`.
>
> Of course, we need some numerical values to work with, so we will suppose that the loan amount is \$1500, the interest rate is 1% and the number of payments is 10. The required code is then

```
intRate <- 0.01
n <- 10
principal <- 1500
payment <- principal * intRate / (1 - (1 + intRate)^(-n))
payment

## [1] 158.3731
```

> For this particular loan, the monthly payments are \$158.37.

In each question below, write out (or type) the required lines of R code, together with the answer to the question.

1. Calculate the monthly payment required for a loan of \$200,000, at a monthly interest rate of 0.003, based on 300 monthly payments, starting in one month's time.

2. The volume V of a sphere of radius r is given by

$$V = \frac{4}{3}\pi r^3.$$

   Use R to calculate the approximate volume of Earth, assuming a radius of 6378 km. Assign the result to an object named `volumeEarth`.

3. Calculate the remainder after dividing 31079 into 170166719.

4. Calculate the interest earned after 5 years on an investment of \$2000, assuming an interest rate of 3% compounded annually.

5. Using one line of R code, calculate the interest earned on an investment of \$2000, assuming an interest rate of 3% compounded annually, for terms of 1, 2, ..., 30 years.