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. (5 points)

```
intRate <- 0.003
n <- 300
principal <- 200000
payment <- principal * intRate / (1 - (1 + intRate)^(-n))
payment

## [1] 1012.005
```

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 points)

```
r <- 6378
volumeEarth <- 4*pi*r^3/3
```

3. Calculate the remainder after dividing 31079 into 170166719. (1 point)

```
170166719%%31079

## [1] 9194
```

4. Calculate the interest earned after 5 years on an investment of $2000, assuming an interest rate of 3% compounded annually. (2 points)

```
int <- 0.03
investment <- 2000
intearned <- 2000*(1+0.03)^5-2000
intearned

## [1] 318.5481
```

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. (4 points)

```
2000*(1+0.03)^(1:30)
```

```
##  [1] 2060.000 2121.800 2185.454 2251.018 2318.548 2388.105 2459.748
##  [8] 2533.540 2609.546 2687.833 2768.468 2851.522 2937.067 3025.179
## [15] 3115.935 3209.413 3305.695 3404.866 3507.012 3612.222 3720.589
## [22] 3832.207 3947.173 4065.588 4187.556 4313.183 4442.578 4575.855
## [29] 4713.131 4854.525
```