Wk 2. R studio, Big Data

CH 1, CH2

Terminology 1

- Accuracy vs. Precision

  - **Accuracy** is how close a measured value is to the **actual (true) value**.
    => Average ("Accuracy" in Korean?)

  - **Precision** is how close the measured values are **to each other**.
    => Variance ("Precision" in Korean?)

Calibration?

http://www.mathsisfun.com/accuracy-precision.html

Terminology 1 (2)

- Accuracy vs. Precision
  - **eg 1. Thermometer:**

    Device 1: 37.34 ˚C

    Device 2: 37 ˚C

    Q. Which one is more expensive? Do you need an expensive one?

    Q. Is the fraction ".34" meaningful?

  - **eg 2. CO2 Sensor:** ± 30 ppm ± 3%

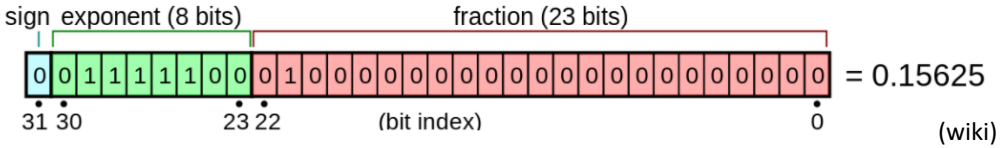
    400 - (30 + (400 * 0.03) = 358ppm ~ 400 + (30 + (400 * 0.03) = 442ppm

    (https://www.co2meter.com/blogs/news/170700807-co2-measurement-range-why-it-matters)

  - **eg 3. Speed Gun:** ± 10% (40km/hr => 36 km/hr ~44km/hr)

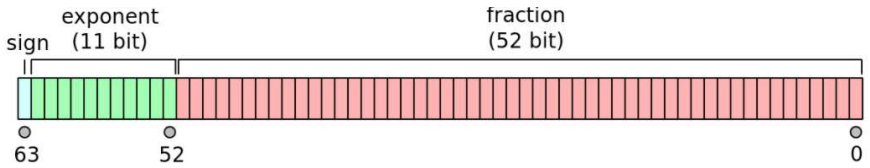
Terminology 1 (3)

- Digital Data Precision ?
  - Integer:
    - Largest integer in R: 2,147,483,647 (How may bits?)
  - Floating Point Number:
    - Single Precision FP Number: 32bits



(wiki)

    - Double Precision FP Number:64bits

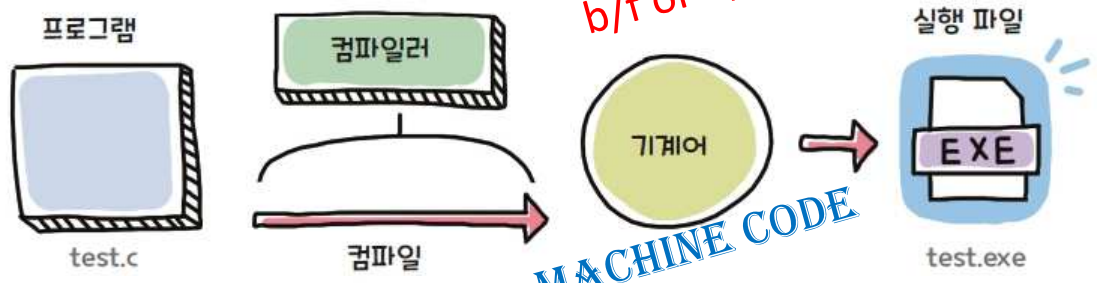


    - Maximum Double number in R: 1.797693e+308

Compilation vs. Interpretation

COMPILATION

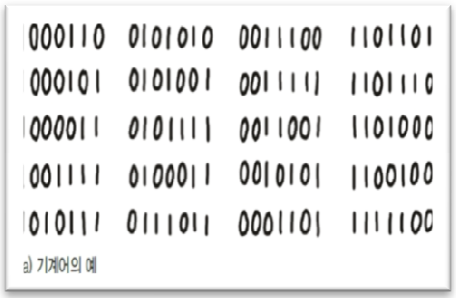
b/f or d/r Execution Time?



(b) 컴파일을 통한 실행 파일이 생성

그림 1-7 프로그램이 만들어지는 과정

```
Include <stdio.h>
Int main() {
   printf("Hello World");
}
```



a) 기계어의 예

_____ code?

_____ readable

_____ readable

Compilation vs. Interpretation

INTERPRETATION

- Interpretation: Machine Code generation is postponed until execution time!
- Compilation based languages: _____
- Interpretation based languages: _____
- Pros and Cons of Interpretation ?

	Complied Lang	Interpreted Lang
Performance (Speed)		
Maintenance / Upgrade		
Platform Independency		

Installing R & R-Studio

- Installing R: https://www.r-project.org/
- Installing R-Studio: https://www.rstudio.com/

a/b R

LET'S FIND OUT WHAT R LANGUAGE IS!

Characteristics of R

- R is a relatively new programming language
- R was developed by Ross Ihaka and Robert Gentleman of Auckland University, New Zealand in 1993 as a Statistical Programming languages called "S-PLUS" (Free Version)

그림 1-8 R 언어 로고

CHARACTERISTICS OF R

Specialized for Data Analysis

- R is a language developed for data analysis & statistics.
- R can be run immediately without compilation to see the results.
- What you write in R is called a "**script**", not a "**program**".

A strong user community

- R has a strong user base, so there are a variety of communities.
- There are also plenty of learning materials for beginners.
- The number of Korean-language online materials / sites are increasing too.

R HAS STRONG USER COMMUNITIES!

- "R-bloggers" Community

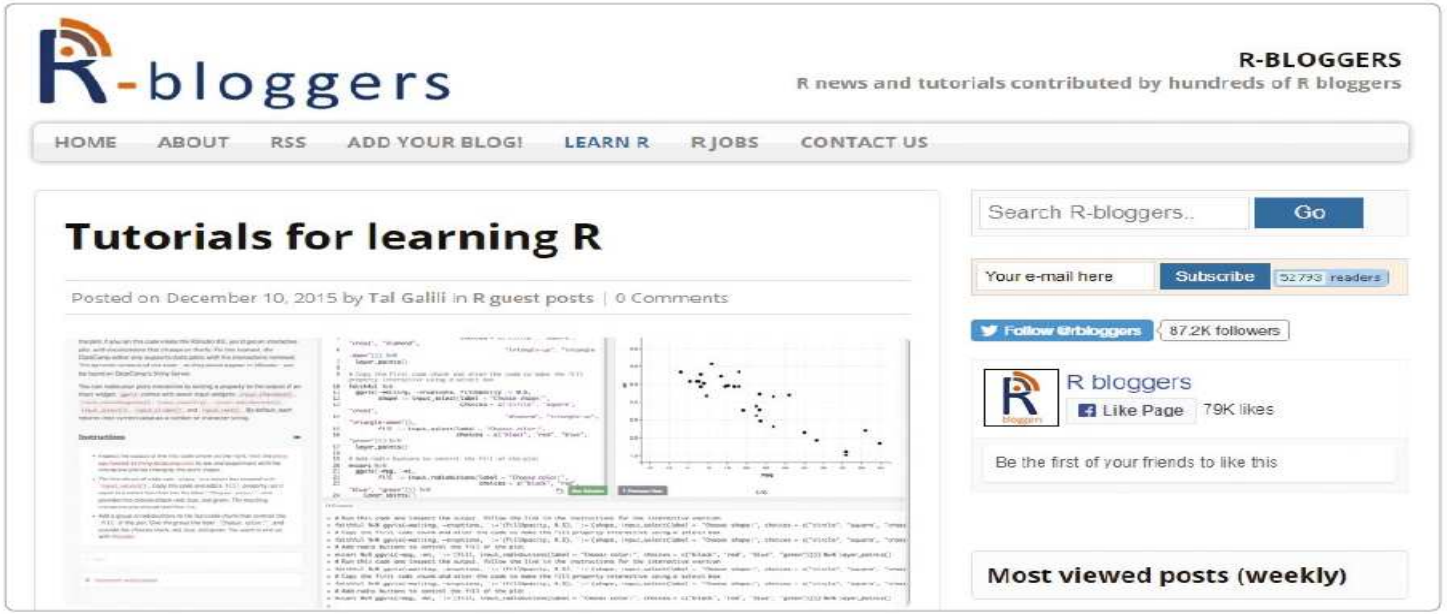


그림 1-9 대표적 R 커뮤니티 R-bloggers(https://www.r-bloggers.com/)

CHARACTERISTICS OF R

Variety of Packages

- R bundles the functions used for data analysis into packages
- Almost all the features for Data Analysis!
- When the latest theory is published, an R package is created immediately, so it is possible to quickly utilize the latest theory for data analysis

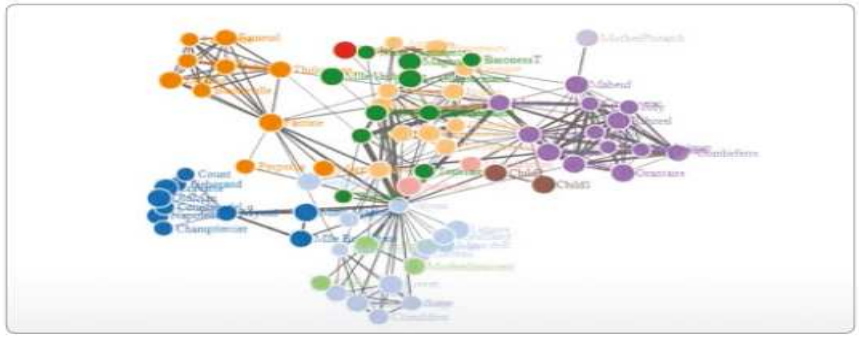


그림 1-10 networkD3 패키지 : 네트워크 형태의 데이터를 시각화하는 데 사용됩니다.

CHARACTERISTICS OF R

Providing **Aesthetic** and **Functional** statistical graphs

- Visual Representation of results is critical in Data Analysis.
- R makes it easy to create beautiful and functional graphs with a package called "ggplot".

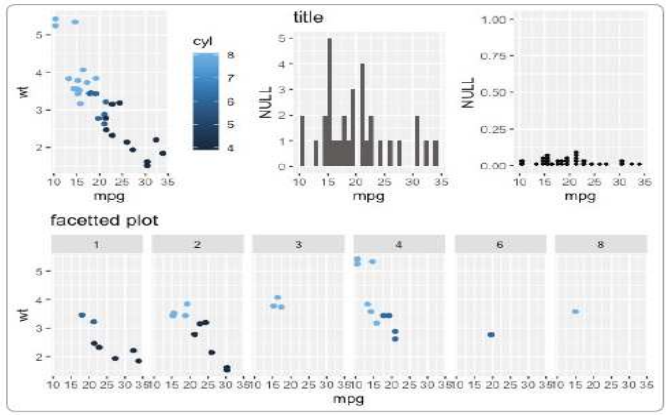


그림 1-11 ggplot 그래프의 예

User-friendly Programming Environment

- R-Studio, integrated development environment (IDE) is provided to handle all tasks of R programming!

CHARACTERISTICS OF R

R-Studio

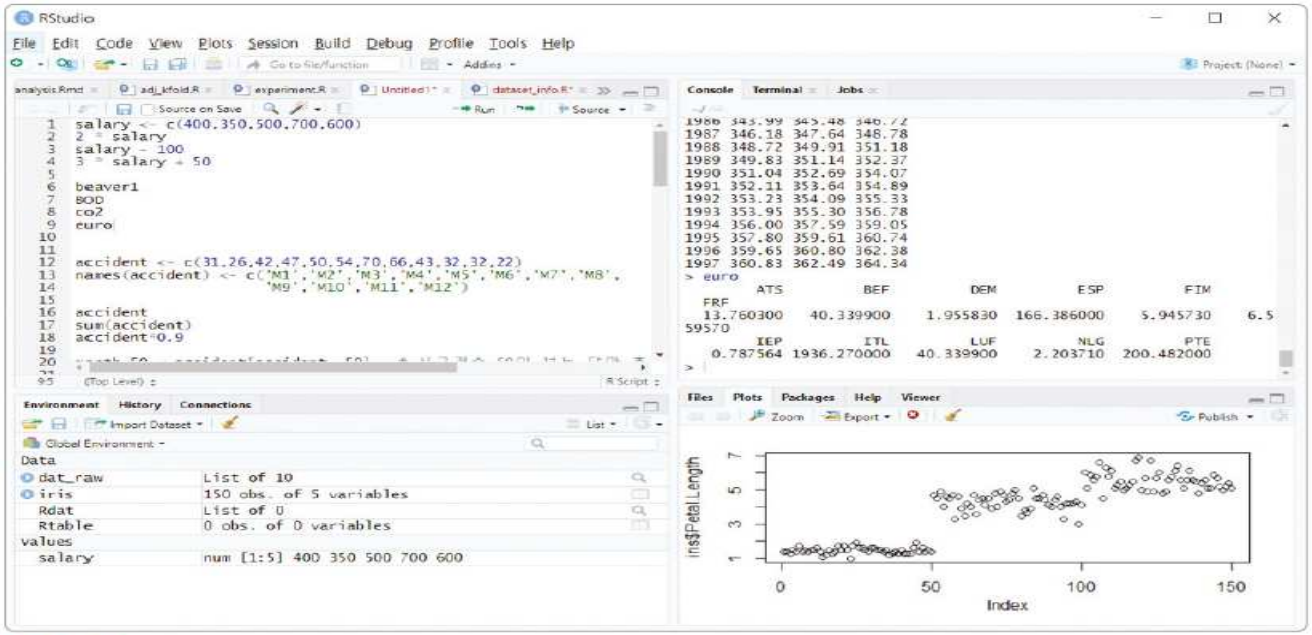


그림 1-12 R 스튜디오 실행 화면

Free!

- R is a **free** open source software!
- Regular updates are made one or two times a year to continuously improve functionality.
- R can be installed and used not only in Windows environments, but also in Linux and MacOS environments.

02. Why learn R?

- **The 4th Industrial Revolution :**

  Newly emerged technologies such as AI, Big Data, Block Chain, Robotics, and the IoT hugely impact the entire political, economic, and cultural aspects of our lives.

- The core of the 4th Industrial Revolution is **DATA!**
- Companies and Individuals who manage/control DATA will be the winner!
- Computational Thinking is crucial regardless of majors.

CHARACTERISTICS OF R

Why Learn R?

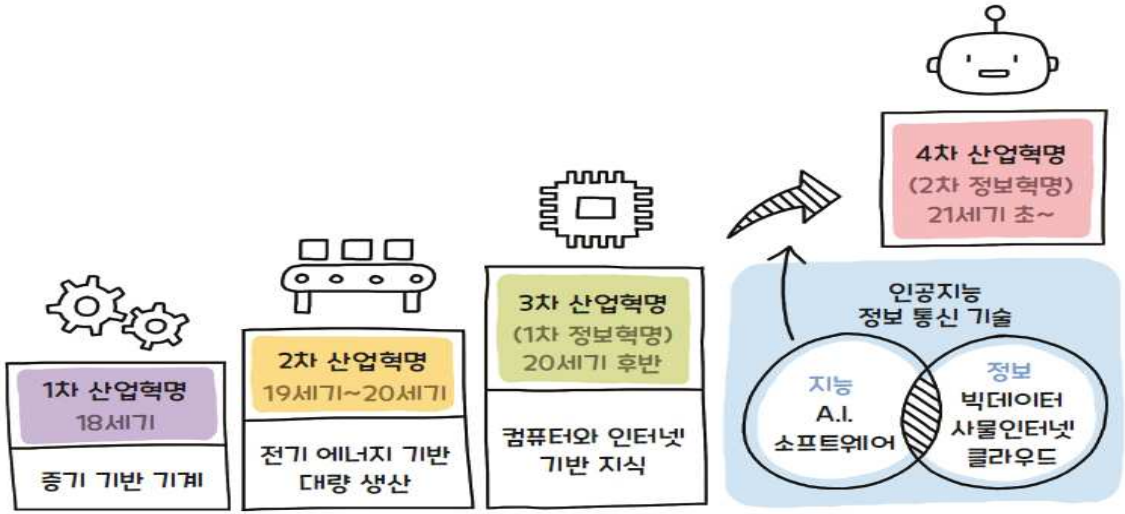
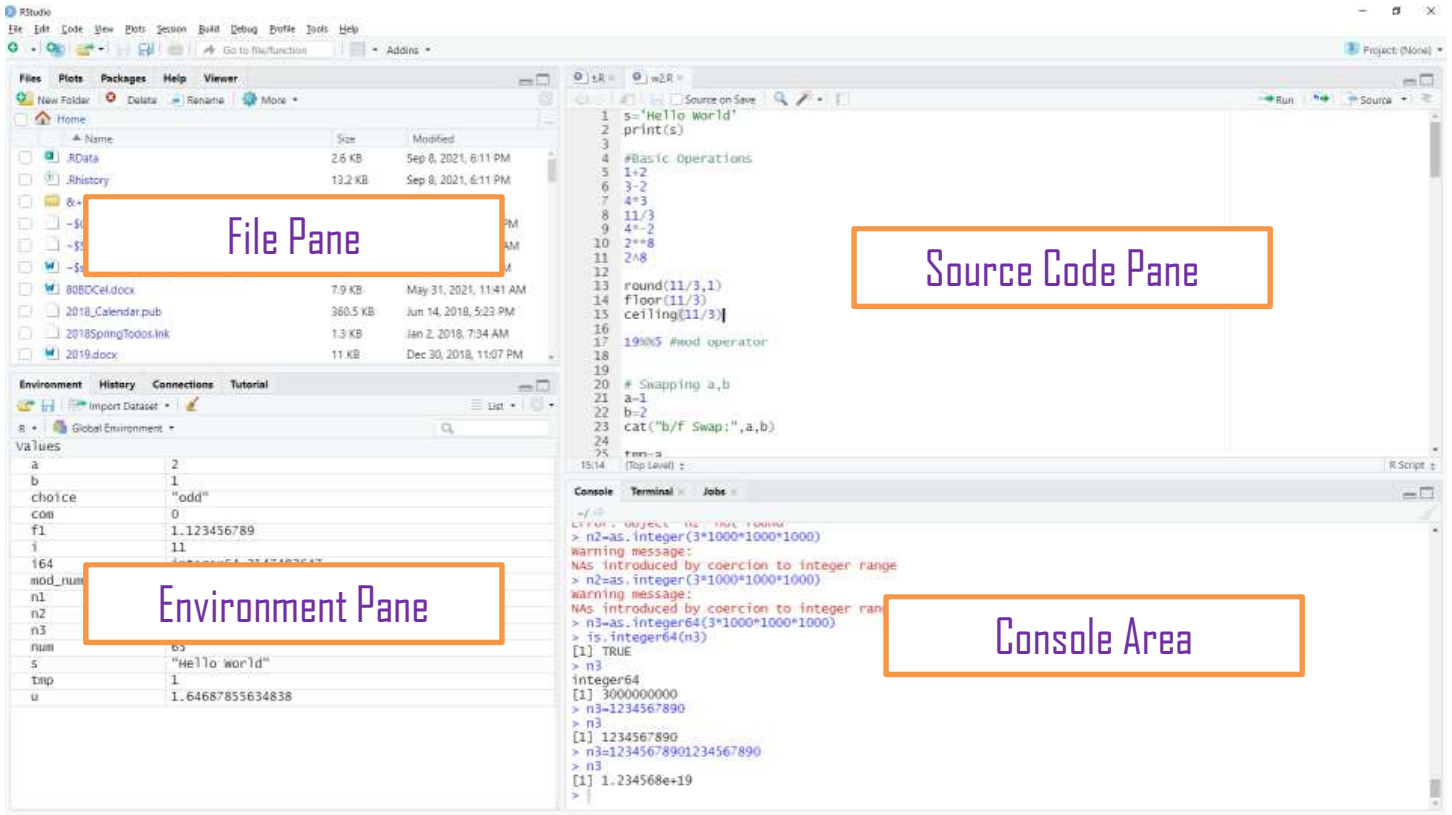


그림 1-13 산업혁명의 발전과 핵심 기술

- R provides easy-to-learn yet powerful data processing and data analysis capabilities.
- Suitable for learning computing thinking by programming .

01
R-Studio Menu & the Screen Layout

R-STUDIO MENU & THE SCREEN LAYOUT



02
Let’s try simple operations

ARITHMETIC OPERATIONS

[Code 2-4]

```
2+3
(3+6)*8
2^3                # 2 to the power of 3
```

[Result]

```
> 2+3
[1] 5
> (3+6)*8
[1] 72
> 2^3              # 2 to the power of 3
[1] 8
```

ARITHMETIC OPERATPRS

Operators

표 2-2 R에서 자주 사용하는 산술연산자

연산자	의미	사용 예
+	덧셈	3+5+8
–	뺄셈	9–3
*	곱셈	7*5
/	나눗셈	8/3
%%	나눗셈의 나머지	8%%3
^	제곱	2^3

Comments

[Code 2-5]

```
7+4
# 2^3
```

```
> 7+4
[1] 11
> # 2^3
>
```

* Try Ctrl + Shift + C !

03

R Packages

Packages:

- A Package is the collection of related functions for series of Analysis

그림 2-5 패키지의 개념

B/f using a Package

- **Loading** is required b/f using packages
- Packages should be installed in a fold of your computer
- If there is none, download and install it first

Install and Use

① Install the right package for the functions you want to use

② Load the package

- The package needs to be installed only once, but the package load is required each time R Studio starts.

그림 2-6 패키지 사용 방법

Package Installation and Usage

Install a package using command prompt

- install.packages()

[Code 2-7]

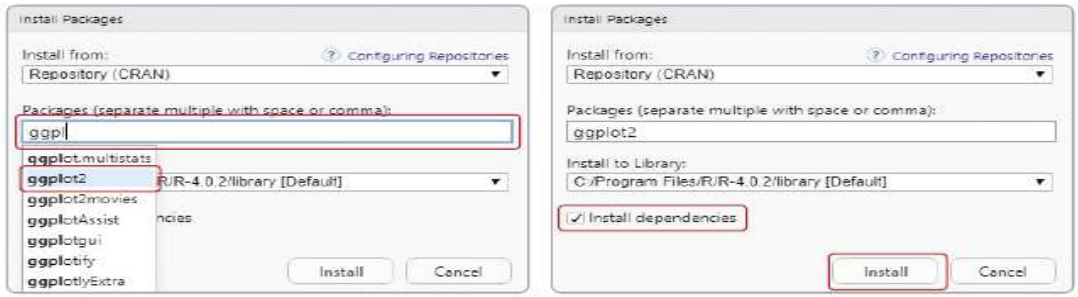
```
# ggplot2 package
install.packages('ggplot2')
```

```
# Load and use
Library(ggplot2)
ggplot(data=iris,aes(x=Petal.Length,y=Petal.Width))+geom_point()
```

PACKAGE INSTALLATION BY MENU

- **Package Installation by Using R-studio**

(a) 패키지창 화면



(b) 패키지 설치 화면

그림 2-7 R 스튜디오 메뉴로 패키지 설치하기

Today's Proverb

- "Give me six hours to chop down a tree and I will use the first four sharpening the axe"

(Abraham Lincoln)

Gmshtcdat alwstffsta

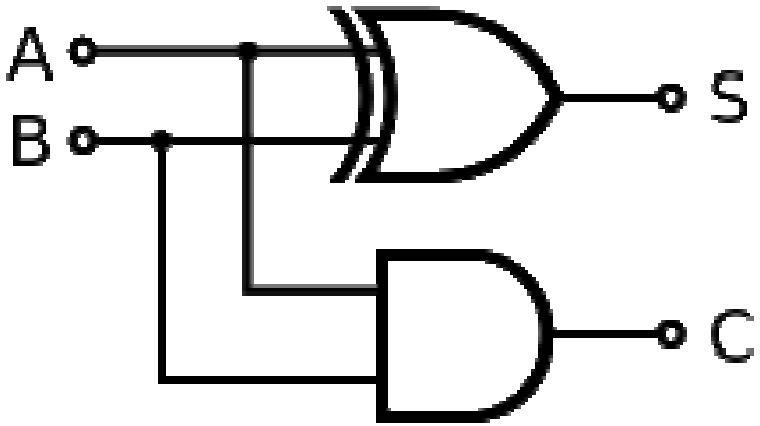
https://wise4edu.com/init/#s4

Programming 101: Truth Table

Q. Can you make a linear model for XOR ?

* https://deepdatascience.wordpress.com/2017/10/25/linear-regression-vs-and-or-xor-logic/

Adder



- https://en.wikipedia.org/wiki/Adder_(electronics)

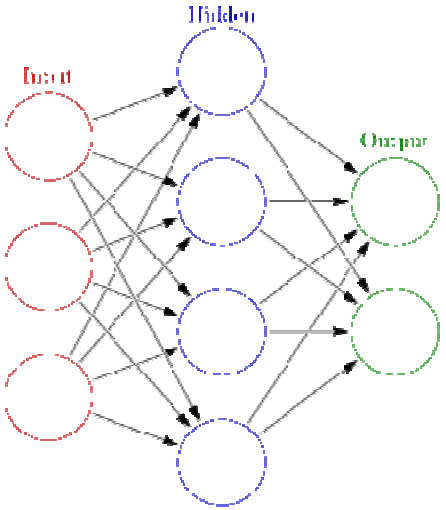
Programming 101: Truth Table (2)

- p: “Today is Thursday” => T/F?
- q: “ Sam is handsome” => T/F?
- p: “Sam is a bike rider” => T
- q: “Sam is the president of Korea” => F
- ~p ?
- r = p AND q vs. r = p OR q

Programming 101: Truth Table (3)

- Quantifier:
  - p: “For all integer n, n>0” => T/F?
  - ~p ?
  - w/ for some?
- Conditional Proposition:
  - If p, then q (p → q) eg:_____
  - Truth table of p → q (Advanced)

Q. What a/b ANN for XOR?



* https://stackoverflow.com/questions/41712420/can-an-ann-of-2-neurons-solve-xor

Big Data: Definition

- "an accumulation of data that is too large and complex for processing by traditional database management tools"

  (merriam-webster.com)

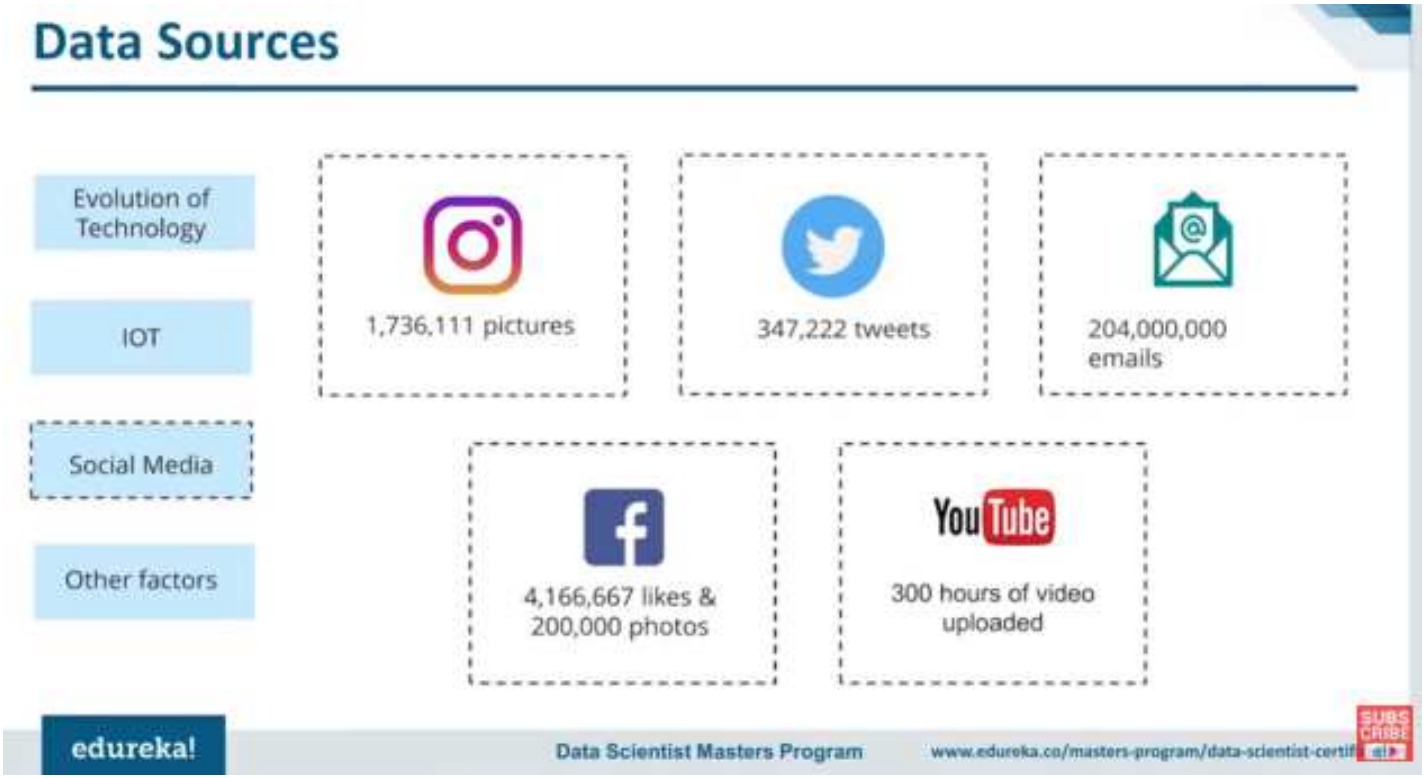
- Various Types: Photos, Audios, Videos, SNS, GPS, IoT, Shopping list, and even Clicks on web browsers (probably soon where you look at)

Big Data: Characteristics

- 3Vs (+ more Vs):
  1. **Volume**: Giga-bytes ~ Zeta-bytes
  2. **Velocity**: 5G, 6G~
  3. **Variety**: texts, transactions, logins , videos and so on
  4. **Veracity**: quality of data
  5. **Value**: worth of processed data

  …. What about **Privacy**?

Big Data generation per minute



*Data Science For Beginners | Edureka

Big Data: IoT

* Pixabay.com

Big Data: Applications

- Government
- Business
- Healthcare, Science
- Education
- Technology, Military
- Culture: Media, Entertainment, Sports, Arts, ..
- International Development

and indeed all areas, fields, and aspects of lives

Big Data: Cases / Stories (1)

- **Netflix**: Data Collected from over 200M Subscribers to deliver customized Streaming service beating giants like Disney

- **Target**: If a woman starts buying unscented lotion, they identifies her as "Pregnant Customer"

Big Data: Cases / Stories (1)

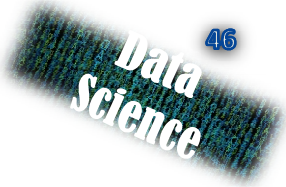
여름에는 "치맥지수", 미세먼지 많은 날에는 "삼결살지수"

* 빅데이터 생활을 바꾸다 (BC카드빅데이터 센터)

Next Week Topics

- Variable, Vector, Function
- **Open Data**

To-dos for Next Class (Flipped Learning)



- **Try enough R codes!**

  (Think a/b how to become a good chef)

  – Self-Game project #1: "RSP" Game

- **Textbook**

  – Read ch3

Any Question?

Thank you for your attention!