情報基礎B (Computer Literacy)
Lecture 1: Course Overview

Matias Korman

Tohoku University Graduate School of Information Sciences
System Information Sciences
Design and Analysis of Information Systems

About me

- Matias Korman
  - Assistant Professor, Graduate School of Information Sciences
  - http://www.dais.is.tohoku.ac.jp/~mati/
    - Bonus! Find these slides there!
  - mati@dais.is.tohoku.ac.jp
  - Course taught in English
  - Also speak inCatalan, Spanish, French, Italian, Japanese

- Profile
  - First time to Japan in 2003
  - Studied in Tohoku University (06-09)
  - In 2015 returned to Sendai
  - Research in theoretical computer science

Teaching Assistants

- Quentin Labernia
  - English
  - French
  - Some German
  - quentin@dais.is.tohoku.ac.jp

- Aji Kasmaji
  - English
  - Indonesian
  - ajiajikasmaji@gmail.com

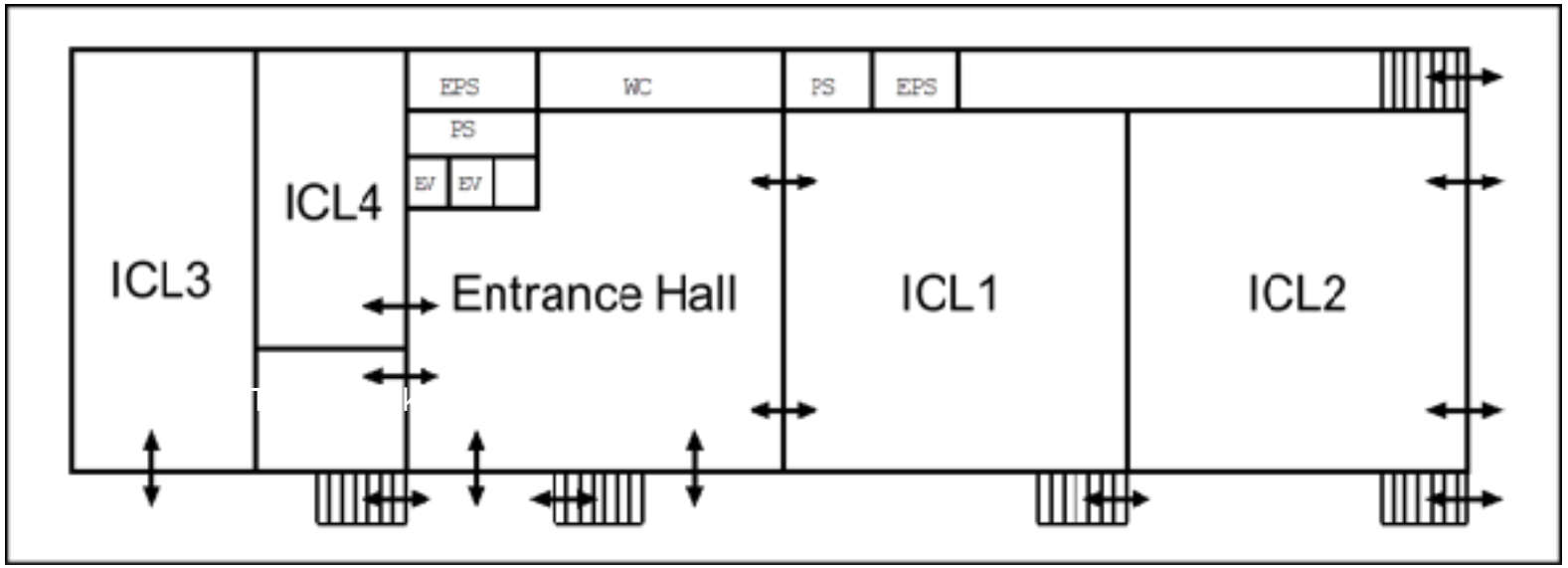
Slides by Jinhee Chun
- Translated into English by Takeshi Tokuyama
- Further edited by me

Course Overview

- Contents
  - Basic knowledge on information technology
    - Usage of computer
    - Ofimatic software
    - The Internet
    - Programming
  - Information society and information ethics
  - Basic usage of a computer (today's goal)
  - Learn the potential of a computer
- Evaluation
  - Assignments (and Attendance)

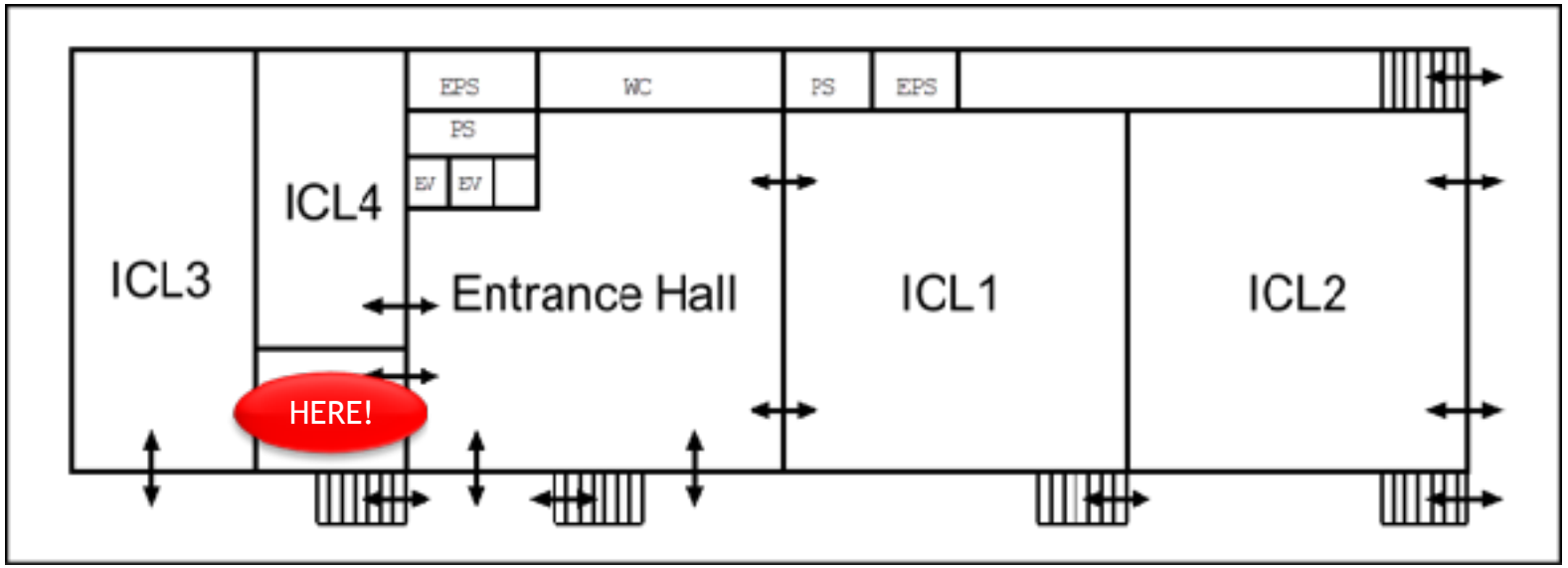
MultiMedia Building

- ICL rooms are open except during lectures
  - ICL1 8:50-17:50 Linux/Windows*152
  - ICL2 8:50-20:45 Linux/Windows*152
  - ICL3 8:50-17:50 Linux/Windows*55, MacOS*2
  - ICL4 8:50-20:45 MacOS*20



MultiMedia Building

- Technical Assistants are available for your question
  - 09:00-17:50 Assistant room(red circle below)
  - 18:00-20:45 ICL2,3



Computer system in Campus

- Operating System
  - Windows
  - Secure
- Attention!
  - Computers are powerful tools
  - Can also be harmful
  - Handle with ethics and responsibility

You know all of this

Basic Usage of Windows

- Desktop environment
  - Mouse operation
  - Application startup
- Application example
  - Command prompt: programming
  - Text editor: Word
  - Spreadsheet: Excel
  - Presentation: PowerPoint
  - Internet Browser: Fire Fox, Chrome, Tor

Don’t use Microsoft explorer

Linux

- Common Desktop Environment(CDE)
  - Visual environment (windows-like)
  - More powerful via command line
- Application examples
  - Terminal: command line operation, programming
  - Text editor: K write
  - Mailer
  - Internet browser

TDLR: More complicated and powerful

Login

You know all of this

- Turn on machine and display
  - Select an OS(Linux or Windows)
- Enter your user ID and password

User ID and Initial Password

- User ID
  - Allocated by system administrator
  - Two different IDs
    - Tohoku University ID
    - Student ID
- Password
  - Decided by user
  - NEVER share
- Initial Password
  - Given by system administrator
  - Generated from your personal information
  - Change immediately

1　利用者番号と初期パスワードについて

教育用電子計算機システムを利用するためには，利用者番号と初期パスワードが必要です。

（例）
学籍番号：　A9JB1234　生年月日：　1990年1月1日
名前：　徳山（トクヤマ）　出身高校所在地：　東京

- 利用者番号には，学籍番号（アルファベットは小文字）を利用します。

利用者番号は [a9jb1234]

- 初期パスワードは，各自，手計算により算出します。算出方法は，裏面を参照して下さい。

初期パスワードの算出

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図1

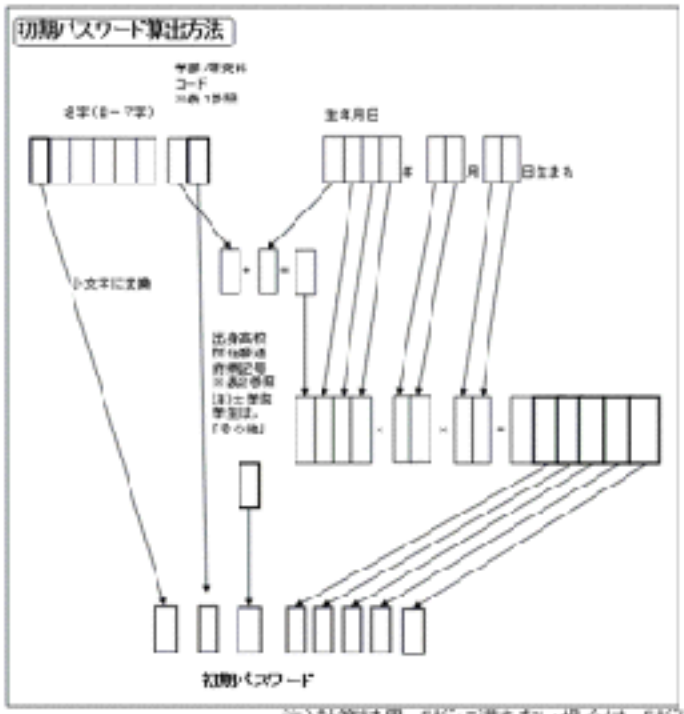

表1.
学部/研究科コード一覧

コード	学部/研究科名
01	文学部
02	教育学部
03	法学部
04	経済学部
05	理学部
06	医学部
07	薬学部
08	医学部
09	工学部
10	農学部
21	文学研究科
22	教育学研究科
23	法学研究科
24	経済学研究科
25	理学研究科
26	医学系研究科
27	薬学研究科
28	医学研究科
29	工学研究科
30	農学研究科
41	国際文化研究科
42	情報科学研究科
43	生命科学研究科
44	教育情報学教育部
45	環境科学研究科
50	医療技術短期大学部

表2.
出身高校所在都道府県記号一覧

都道府県	記号	都道府県	記号
北海道	a	大阪府	A
青森県	b	兵庫県	B
岩手県	c	奈良県	C
宮城県	d	和歌山県	D
秋田県	e	鳥取県	E
山形県	f	島根県	F
福島県	g	岡山県	G
茨城県	h	広島県	H
栃木県	i	山口県	I
群馬県	j	徳島県	J
埼玉県	k	香川県	K
千葉県	l	愛媛県	L
東京都	m	高知県	M
神奈川県	n	福岡県	N
新潟県	o	佐賀県	O
富山県	p	長崎県	P
石川県	q	熊本県	Q
福井県	r	大分県	R
山梨県	s	宮崎県	S
長野県	t	鹿児島県	T
岐阜県	u	沖縄県	U
静岡県	v	その他 留学生 大検合格者 大学院学生	V
愛知県	w		
三重県	x		
滋賀県	y		
京都府	z		

注)計算結果、5桁に満たない場合は、5桁になるように先頭に0をつけること。

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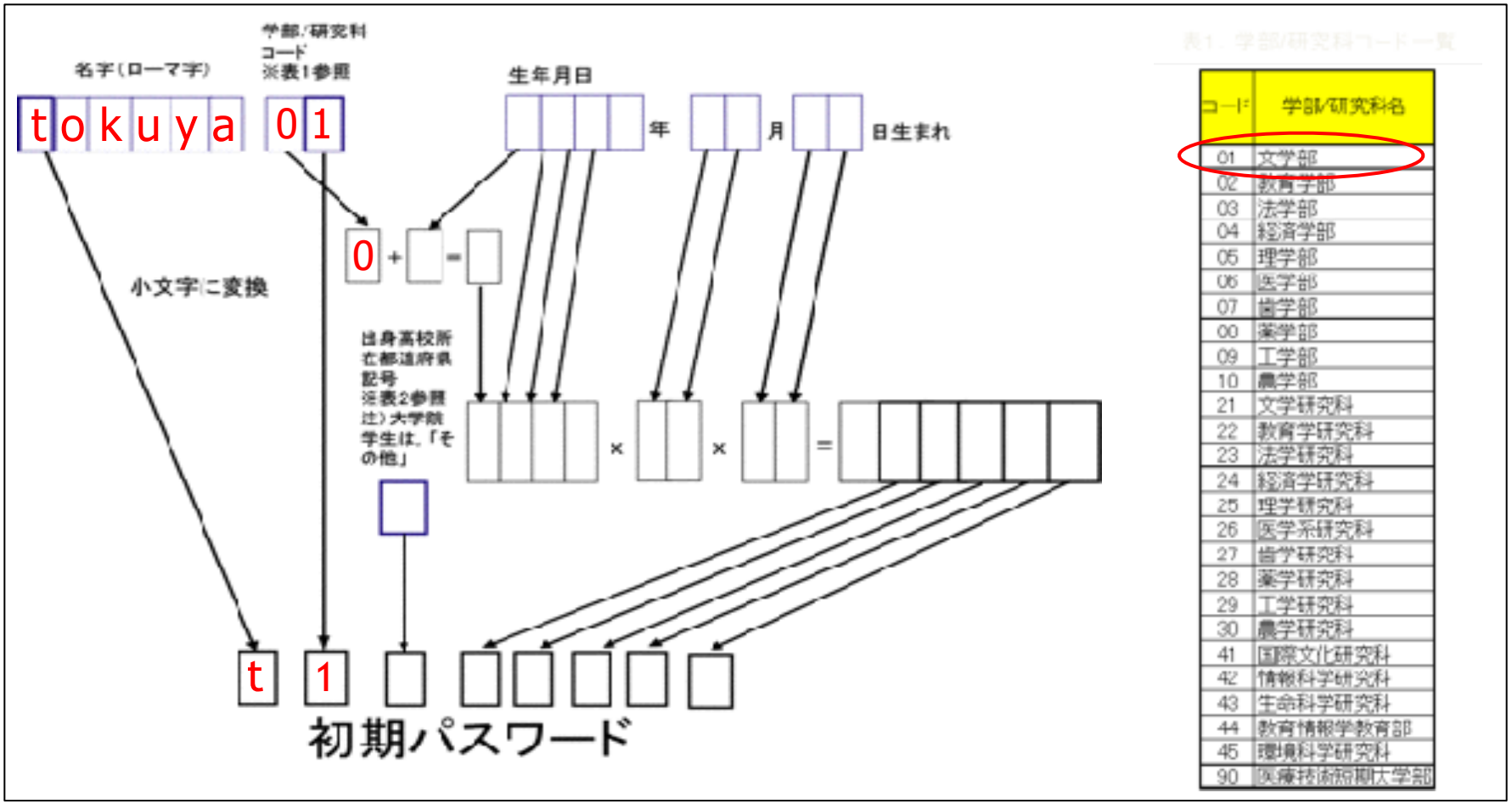

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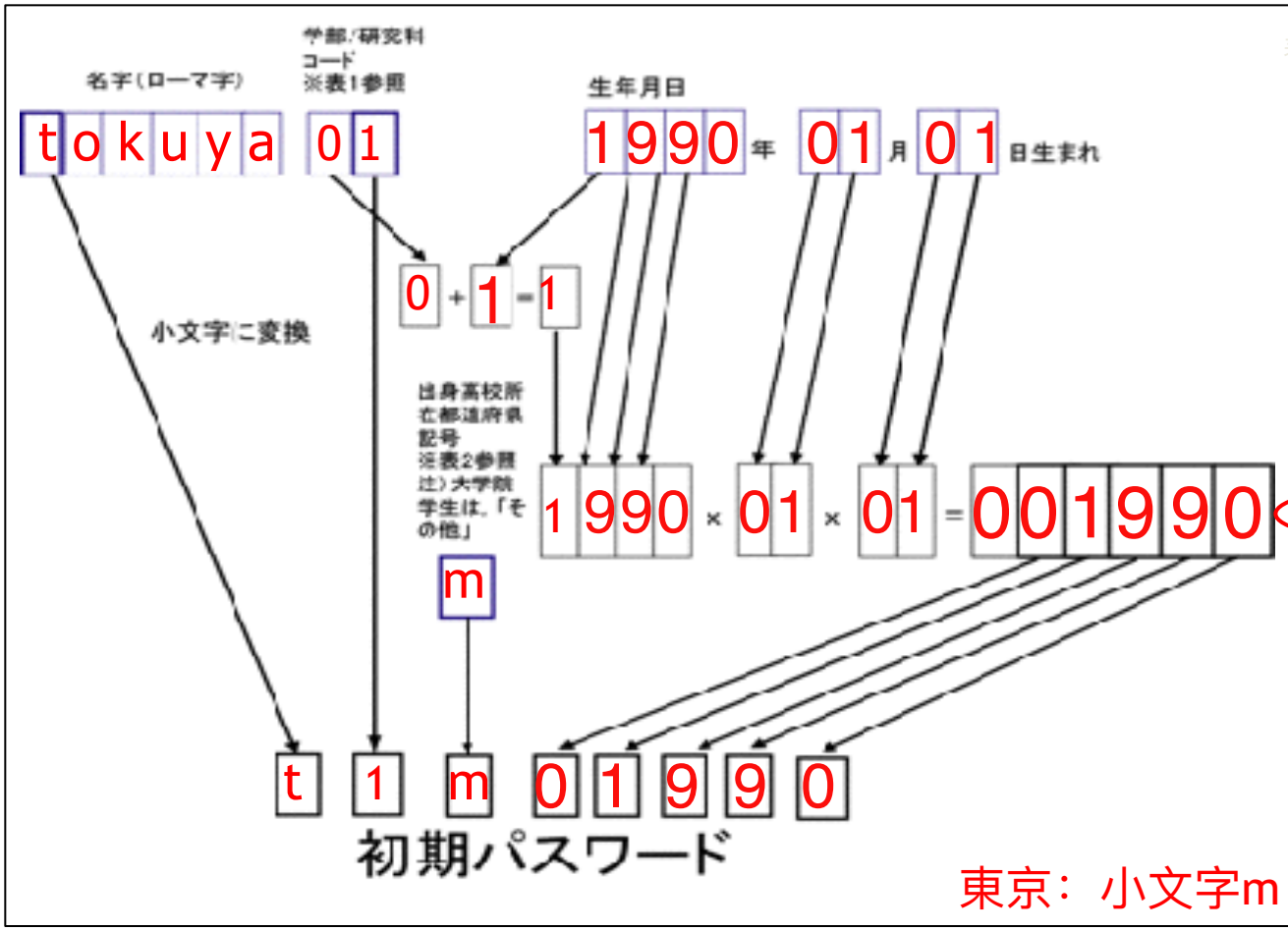

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岩手県	c	奈良県	C
宮城県	d	和歌山県	D
秋田県	e	鳥取県	E
山形県	f	島根県	F
福島県	g	岡山県	G
茨城県	h	広島県	H
栃木県	i	山口県	I
群馬県	j	徳島県	J
埼玉県	k	香川県	K
千葉県	l	愛媛県	L
東京都	m	高知県	M
神奈川県	n	福岡県	N
新潟県	o	佐賀県	O
富山県	p	長崎県	P
石川県	q	熊本県	Q
福井県	r	大分県	R
山梨県	s	宮崎県	S
長野県	t	鹿児島県	T
岐阜県	u	沖縄県	U
静岡県	v	その他・留学生・大検合格者・大学院学生	V
愛知県	w		
三重県	x		
滋賀県	y		
京都府	z		

Initial Password

Anyone can generate from your basic information.
Leaving initial password can cause
ACOUNT HACKING

Change it NOW at “Integrated Electronic Authentication System Login” in CITE website

Compliance

Be specially careful when using university computers

- No online purchases
- No movie downloading
- Don’t send missiles to North Korea
- Don’t print counterfeit money

You know all of this

Course Registration

- Open your Internet Browser
  - Go to “Teaching Support System” in CITE website
  - Login and click course registration
- Only registered user can use PC in a course (otherwise forced to logout)

This registration is only valid in Multi Media Building and not related to grading system.

Homework

- Prepare a 5 minute presentation
- Topic: Information Society and Ethics

Important! Counts for final grade!

  - Give your opinion
  - Possible solutions
  - Make slides in (preferably PDF)
- Deadline: 16 October

情報基礎B (Computer Literacy)
Lecture 2: Ethics and Security

Matias Korman

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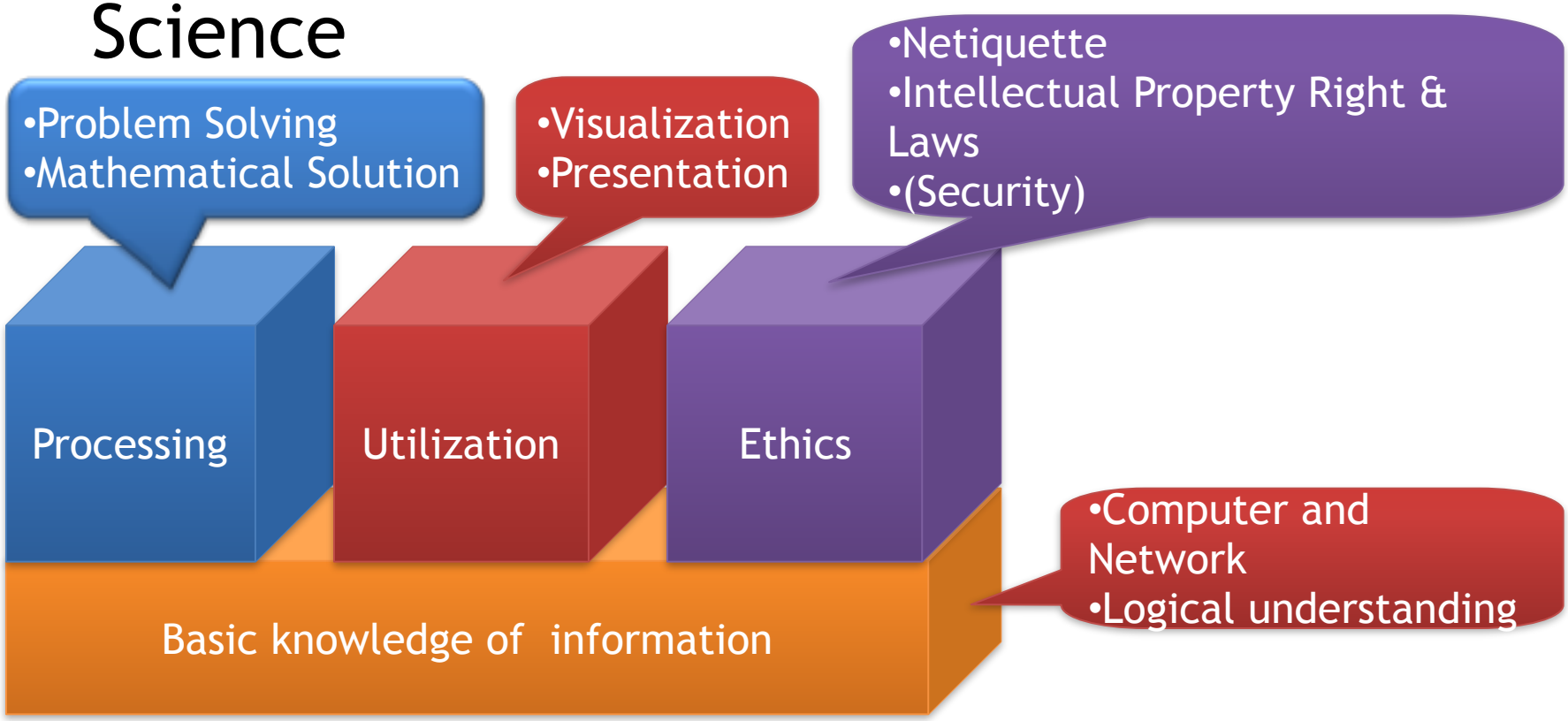
Design and Analysis of Information Systems

Course Overview

- Acquisition of basic knowledge on Information Technology and Information Science



Course Information

- Mostly Slides
- Exercises done in class
- Classic textbook
- Internet
- Handouts

Print out limitation is 120 Pages/ Semester

Information Ethics

- Ethics
  - Right attitude as a human in society

Do not harm others

(Justice)・礼(Politeness)・智(Wisdom)・信(Honesty)

- Information Ethics

Do not harm others using computers

Not even by accident!

Information in Society

- Humanity has evolved along with information
- Major evolutions
  - Language
  - Paper+Pen
  - Printing
  - (physical) mail
  - Telegram
  - Telephone
  - …
  - Internet
    - Email, Web, Blog, Twitter, Facebook
- Human culture depends on information infrastructure and information exchange

Information in Society

- Humanity has evolved along with information
- Major evolutions
  - Language
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- Human culture depends on information infrastructure and information exchange

Benefits and Risks of the Internet

- Benefit
  - World wide scale
  - Lots of information available
  - Easy to publish and share
  - Make distances shorter
  - Each person takes part in a huge events
    - Facing unspecified large number of people
- Risk
  - Individual act leads to a large effect
  - Many malicious uses
  - Small mistakes have big impact
- With great power comes great responsibility
- Use internet wisely

Is this new?

- First documented case is in December 1941
  - Pearl Harbor
  - Japanese destroyed eight battleships
  - High presence in media
  - “Forced” US to join WWII
- Now happens in a larger scale
  - Russia interference in US election
  - Police tweeted “about to raid a terrorist cell”
  - Clickbait news
  - Need to be “first”
- Everyone can access a large audience easily
  - Everyone should study information ethics!

What can we do?

- LEARN
  - Do not believe any news you see
  - Numbers can be easily tweaked
  - Small mistakes have big impact
  - Try to contrast the news
  - Be mindful of “schauenfreude”
  - Do not share if you are not certain
    - Most people only read caption

- With great power comes great responsibility
- Use internet wisely

Crimes one may commit

- Violation of Privacy
  - Stronger than freedom of speech
  - Disclosing a private life of others
    (tweet the location of a famous person)
- Defamation
  - Blaming, Discrimination
    (you could go to jail for trolling!)
- Piracy
  - Using information from others without permission
  - Putting your photo of a celebrity
  - Your computer used as spambot
- Gambling, trickery, pyramid selling
  - Your loss fuels loss for others

Illegal acts we ALL do daily

- Registering in some website with a fake name
  - 5 to 20 years!
- Using an open wi-fi without consent
  - Open does not mean “please use”
- Posting someone else’s image
  - Giving credit is not enough
- Sharing password with family
  - My wife cannot benefit from my Netflix!
- Registering with a fake name
  - 5 to 20 years!
- Selling on eBay
  - Did you declare taxes?

Law point of view

- Prohibited by law
  - Human rights violation (right to privacy, to be forgotten, etc)
  - Easier than regular crimes
    - You do not see anyone suffer
    - Easy to anonymize
- Unconscious misconduct
  - Lack of awareness is your fault
- Unethical acts should be avoided

Don’t hack your professor’s PC!

How to make a good password?

WINDOWS: Please enter your new password.
USER: cabbage

WINDOWS: Sorry, the password must be more than 8 characters.
USER: boiled cabbage

WINDOWS: Sorry, the password must contain 1 numerical character.
USER: 1 boiled cabbage

WINDOWS: Sorry, the password cannot have blank spaces.
USER: 50boiledcabbages

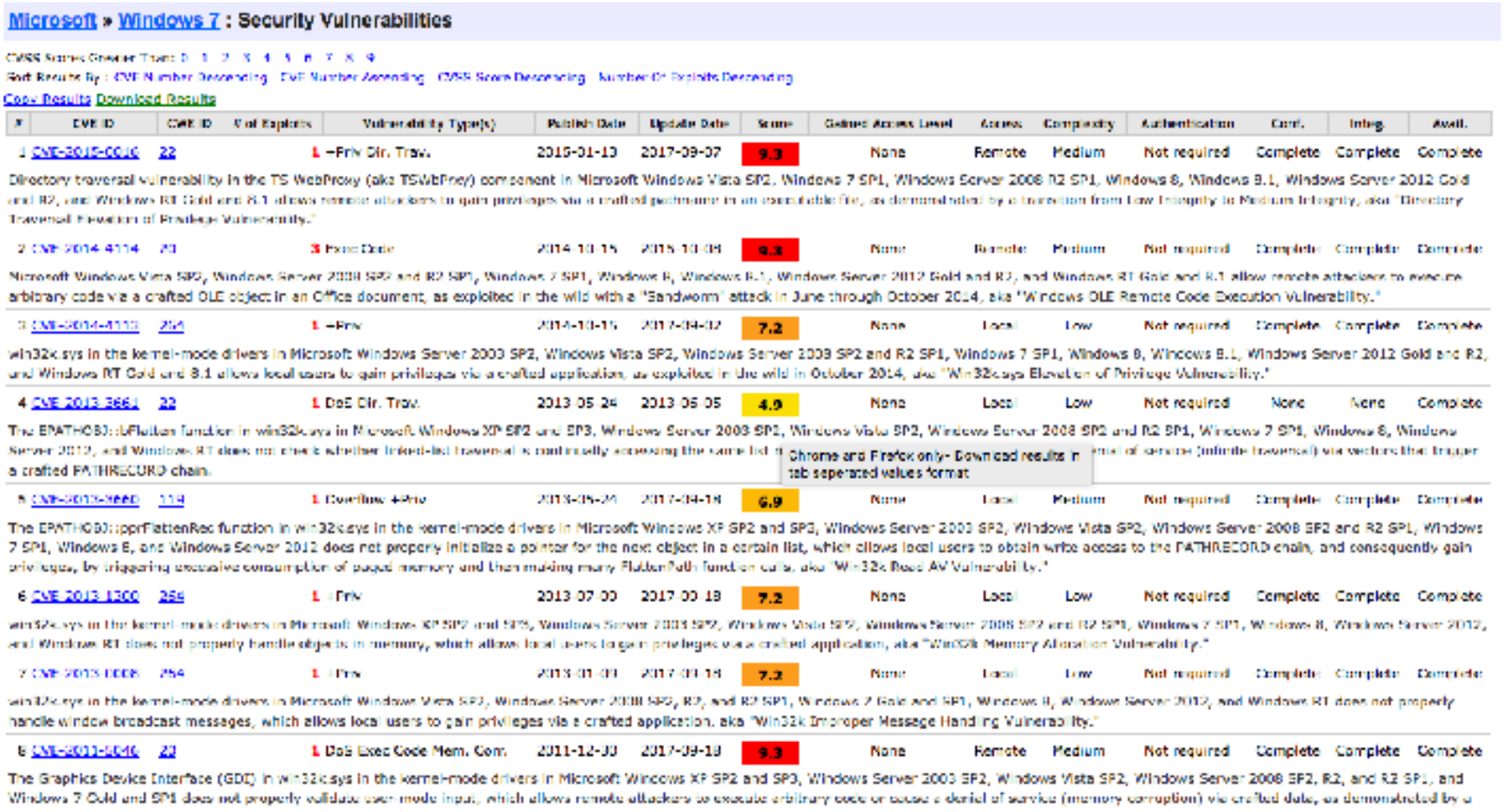
WINDOWS: Sorry, the password must contain at least one upper case character.
USER: 50FUCKINGboiledcabbages

Internet Security

- Having a strong password is essential
- Letters and numbers
- Special characters
- Blood type
- Hair color
- Long password do not make your account safer!
- Do not use the same password in different pages
  - Use an algorithm
  - Even better: password manager

Is this enough?

Internet Security



Microsoft » Windows 7 : Security Vulnerabilities

CVSS Scores Greater Than: 0 1 2 3 4 5 6 7 8 9

Sort Results By : CVE Number Descending CVE Number Ascending CVSS Score Descending Number Of Exploits Descending

Copy Results Download Results

#	CVE ID	CWE ID	# of Exploits	Vulnerability Type(s)	Publish Date	Update Date	Score	Gained Access Level	Access	Complexity	Authentication	Conf.	Integ.	Avail.
1	CVE-2015-0016	22		1 +Priv Dir. Trav.	2015-01-13	2017-09-07	9.3	None	Remote	Medium	Not required	Complete	Complete	Complete

Directory traversal vulnerability in the TS WebProxy (aka TSWebProxy) component in Microsoft Windows Vista SP2, Windows 7 SP1, Windows Server 2008 R2 SP1, Windows 8, Windows 8.1, Windows Server 2012 Gold and R2, and Windows RT Gold and 8.1 allows remote attackers to gain privileges via a crafted pathname in an executable file, as demonstrated by a transition from Low Integrity to Medium Integrity, aka "Directory Traversal Elevation of Privilege Vulnerability."

2	CVE-2014-4114	20		3 Exec Code	2014-10-15	2015-10-08	9.3	None	Remote	Medium	Not required	Complete	Complete	Complete

Microsoft Windows Vista SP2, Windows Server 2008 SP2 and R2 SP1, Windows 7 SP1, Windows 8, Windows 8.1, Windows Server 2012 Gold and R2, and Windows RT Gold and 8.1 allow remote attackers to execute arbitrary code via a crafted OLE object in an Office document, as exploited in the wild with a "Sandworm" attack in June through October 2014, aka "Windows OLE Remote Code Execution Vulnerability."

3	CVE-2014-4113	264		1 +Priv	2014-10-15	2017-08-02	7.2	None	Local	Low	Not required	Complete	Complete	Complete

win32k.sys in the kernel-mode drivers in Microsoft Windows Server 2003 SP2, Windows Vista SP2, Windows Server 2008 SP2 and R2 SP1, Windows 7 SP1, Windows 8, Windows 8.1, Windows Server 2012 Gold and R2, and Windows RT Gold and 8.1 allows local users to gain privileges via a crafted application, as exploited in the wild in October 2014, aka "Win32k.sys Elevation of Privilege Vulnerability."

4	CVE-2013-3661	22		1 DoS Dir. Trav.	2013-06-24	2013-06-05	4.9	None	Local	Low	Not required	None	None	Complete

The EPATHOBJ::bFlatten function in win32k.sys in Microsoft Windows XP SP2 and SP3, Windows Server 2003 SP2, Windows Vista SP2, Windows Server 2008 SP2 and R2 SP1, Windows 7 SP1, Windows 8, Windows Server 2012, and Windows RT does not check whether linked-list traversal is continually accessing the same list [illegible] denial of service (infinite traversal) via vectors that trigger a crafted PATHRECORD chain.

Chrome and Firefox only- Download results in tab seperated values format

5	CVE-2013-3660	119		1 Overflow +Priv	2013-06-24	2017-08-16	6.9	None	Local	Medium	Not required	Complete	Complete	Complete

The EPATHOBJ::pprFlattenRec function in win32k.sys in the kernel-mode drivers in Microsoft Windows XP SP2 and SP3, Windows Server 2003 SP2, Windows Vista SP2, Windows Server 2008 SP2 and R2 SP1, Windows 7 SP1, Windows 8, and Windows Server 2012 does not properly initialize a pointer for the next object in a certain list, which allows local users to obtain write access to the PATHRECORD chain, and consequently gain privileges, by triggering excessive consumption of paged memory and then making many FlattenPath function calls, aka "Win32k Read AV Vulnerability."

6	CVE-2013-1300	264		1 +Priv	2013-07-09	2017-08-18	7.2	None	Local	Low	Not required	Complete	Complete	Complete

win32k.sys in the kernel-mode drivers in Microsoft Windows XP SP2 and SP3, Windows Server 2003 SP2, Windows Vista SP2, Windows Server 2008 SP2 and R2 SP1, Windows 7 SP1, Windows 8, Windows Server 2012, and Windows RT does not properly handle objects in memory, which allows local users to gain privileges via a crafted application, aka "Win32k Memory Allocation Vulnerability."

7	CVE-2013-1299	264		1 +Priv	2013-07-09	2017-08-18	7.2	None	Local	Low	Not required	Complete	Complete	Complete

win32k.sys in the kernel-mode drivers in Microsoft Windows Vista SP2, Windows Server 2008 SP2, R2, and R2 SP1, Windows 7 Gold and SP1, Windows 8, Windows Server 2012, and Windows RT does not properly handle window broadcast messages, which allows local users to gain privileges via a crafted application, aka "Win32k Improper Message Handling Vulnerability."

8	CVE-2011-3346	20		1 DoS Exec Code Mem. Corr.	2011-12-30	2017-09-19	9.3	None	Remote	Medium	Not required	Complete	Complete	Complete

The Graphics Device Interface (GDI) in win32k.sys in the kernel-mode drivers in Microsoft Windows XP SP2 and SP3, Windows Server 2003 SP2, Windows Vista SP2, Windows Server 2008 SP2, R2, and R2 SP1, and Windows 7 Gold and SP1 does not properly validate user-mode input, which allows remote attackers to execute arbitrary code or cause a denial of service (memory corruption) via crafted data, as demonstrated by a

Internet Security

- Security does not depend only on you
  - Even with Firewall and Anti-virus
  - Day 0-vulnerabilities can affect any computer
    - Sell for 200.000$ on black market
    - Update all software!
  - NSA spying on all of us
  - How much data do you have online?
    - One disgruntled employee is all it takes
  - Most nuclear power plants are **infected**
    - Not even aware of them

Security Example 1

- While browsing through internet I saw an add

  Your computer is infected,

  try our antivirus for free!
- Install the program and computer slows down

- Pay for the pro version and no more problems!

Malware (Malicious Software)

- Malware
  - Old ones would destroy your data
    - Possibly ask for ransom money
  - New ones give your information
- How to get infected
  - USB
    - Plug & play devices
  - Internet
    - Downloaded file
    - E-mail attachment
    - Logging to “Free_wifi” network
    - Man in the middle
    - Hard Drive swap
  - Software vulnerabilities
    always update software!

What can they do?

- Steal your money
  - They probably don’t care
  - Your account is payment for other transactions
- Steal your information
  - friends are potential targets
- Destroy data, ask for ransom money
  - WannaCry, Pirates of the Caribbean 5
- Blackmail
  - Do you want your drunk images on Facebook?
  - Have you ever cheated on your boyfriend/girlfriend/dog?
- Become figurehead for larger crimes
- Identity theft
  - Someone could do this course instead of you!

Security Example 2

- Google workers in China use new laptops
- Use computer as little as possible
- Never type passwords with keyboard
  - Use USB authentication
  - Shower with USB
- Throw computer when returning home
- Aren't virus only programs?

How much security do you need?

Security Example 3

- Why was Bin Laden hard to find?
  - He never accessed internet
  - carry a USB key to internet cafe
  - 30 Drive each way

Not practical for us.

Make it not worth the effort!

Self Defense Summary

- Very hard/impossible to be secure
- Make it not worth for hackers
- Never stop learning
- National Police Agency Japan Countermeasure against Cybercrime
  - http://www.npa.go.jp/cyber/english/index.html
- National Consumer Affairs Center of Japan
  - http://www.kokusen.go.jp/ncac_index_e.html

Spam Mail

- 97% of all mail is unwanted
  - Most of it are adds
  - 99.99999% of them end in spam folder
  - 46% of people open them
  - 11% of them click
  - ??% end up in a purchase
- Millions of dollars in benefits!!
- Imagine how fast would internet can be?
- Never support them!

Data Privacy

Or why is Facebook free?

Privacy in Social Networks

Frank

Since Facebook is now an open capital entity and in response to the new Facebook guidelines, I , , hereby declare that my copyright is attached to all of my personal details, including but not limited to 'Illustrations, designs, paintings, renderings, professional photos, business photo's and videos, etc. (as a result of the Berner Convention).

For commercial use of the above my written consent is needed at all times.

I notify Facebook that it is strictly forbidden to disclose, copy, distribute, disseminate, or take any other action against me on the basis of this profile and/or its contents. The aforementioned prohibited actions also apply to employees, students, agents and/or any staff under Facebook's pay, direction or control. The content of this profile is private and confidential information. The violation of my privacy is punished by law (UCC 1 1-308-308 1-103 and the Rome Statute). 11/25/12

Why are Social Networks Free?

- Sell Ads
  - Targeted to specific audience
  - They learn a lot from you
    - What did you click?
    - Whose page do you stalk?
- Several known abuses
  - Selling information on you being sick
  - Sharing that you are homosexual
- How much would a paid SN cost?

Other problems of SN

- Most people get news from social networks
  - Friends share news, more likely to believe
  - Friends think alike -> reinforce your opinion
  - Fake news (more than 50%?)
- Obama's war chest came from social media
- Russia influenced the US election through ads on Facebook
- People share explicit images during terrorist attacks
- Sharing pictures of your ex-boyfriend/girlfriend

How can we be protected?

- Understand that anything you upload will become public
  - Even if sent privately
- Think before you share
- Tweak settings for extra privacy
- Remove metadata of images
- Close old accounts

Further Study

- Movie/TV
  - Fifth Estate
  - Snowden
  - Black Mirror
  - Mr Robot
- Bruce Schneier blog on security (https://www.schneier.com/)
- Essays on Social Sciences (nerdwriter1)
- …

Remember the homework!

- Prepare a 5 minute presentation
- Topic: anything related to what I spoke
  - i.e., internet bullying
    - Introduce the problem
    - Give your opinion
    - Possible solutions
    - Make slides (PDF)
- Deadline: 16 October

情報基礎B (Computer Literacy)
Lecture 3: History of Computers

Matias Korman

Tohoku University Graduate School of Information Sciences
System Information Sciences
Design and Analysis of Information Systems

History of Computers

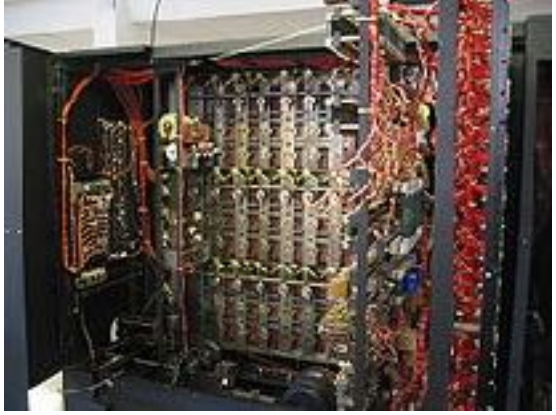
- Computer
  - A machine that carries out arithmetic and logical operation
  - Anything from calculator to supercomputers

Early Computers

- Pascalina by Blaise Pascal (1640?)
- Charles Babbage(1822) programmable
- ABC by Atanasoff-Berry (1942) electronic

http://www.infonet.co.jp/ueyama/ip/history/eniac.html (Japanese)

More ancient history



- George Boole (1815-1864): Boolean Algebra
- Alan Turing(1912-1954): Turing machine: Basic idea of logical process by a computer
  - Church-Turing thesis: Computable functions
    - First tangible benefit of computers
- John Von Neumann (1903-1957)
  - Added “computer program” (stored program)
- Claude Shannon(1916-2001)
  - Information theory

Boolean algebra and computing

- Boolean algebra: Algebra on 0 and 1
  - $0 \oplus 0 = 0,\ 0 \oplus 1 = 1 \oplus 0 = 1,\ 1 \oplus 1 = 1$ (AND operation)
  - $0 \otimes 0 = 0,\ 0 \otimes 1 = 1 \otimes 0 = 0,\ 1 \otimes 1 = 1$ (OR operation)
  - NOT(0) = 1, NOT(1)=0 (NOT operation)
- Every computation can be represented
- Easy to implement electronically
  - Relay, transistor, etc
- Information coding (Shannon) : Transform information into sequences of 0s and 1s

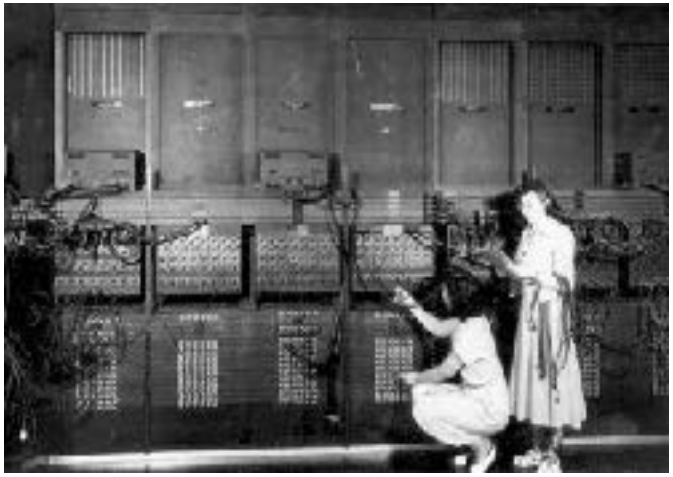
The first “proper” computer

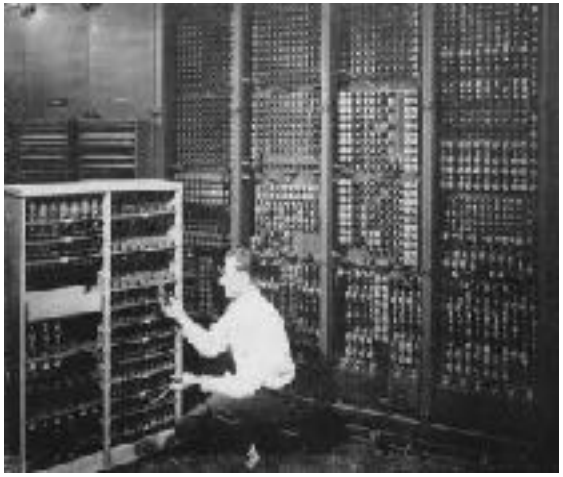
- ENIAC (Electronic Numerical Integrator and Computer)
  - First universal computer
  - Invented by John William Mauchly and John Presper Eckert in 1942

http://www.infonet.co.jp/ueyama/ip/history/eniac.html (Japanese)

Fun facts about ENIAC

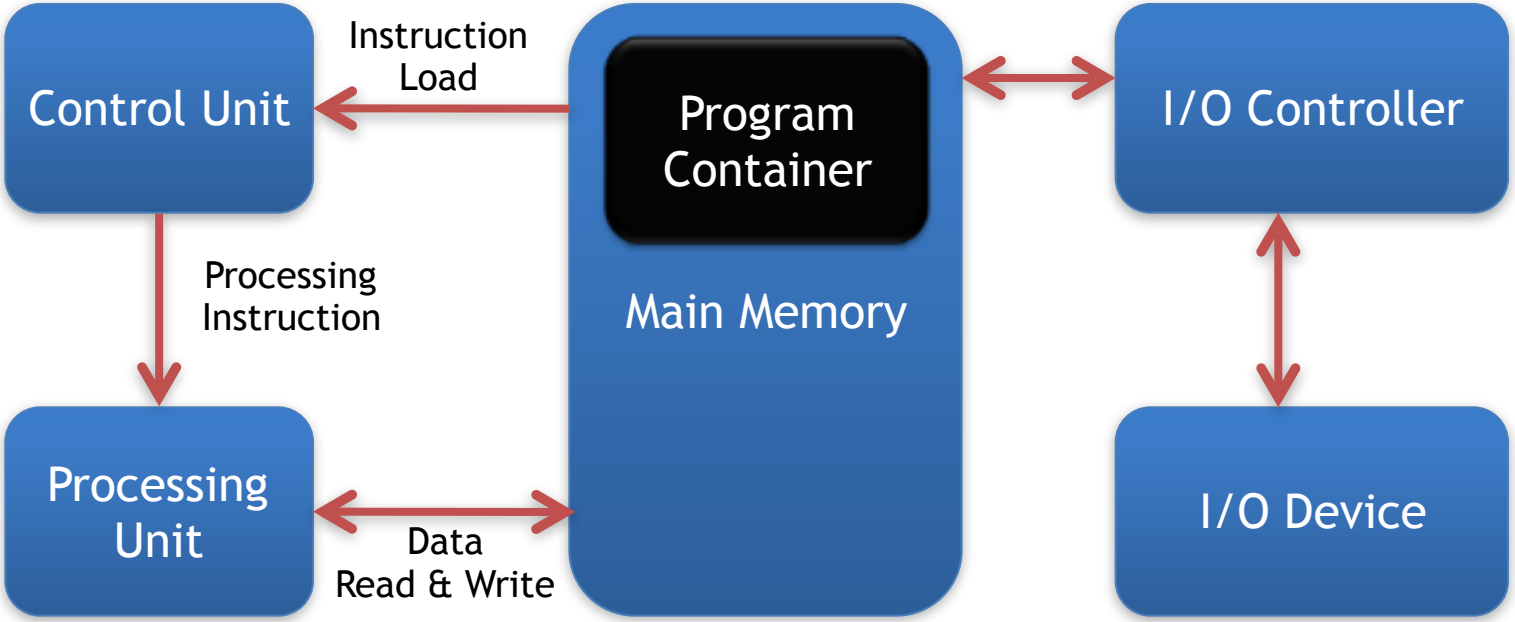
- Floor area: 100m^2, Length: 30m, Weight: 30t, Power Consumption 150kW
- Developed secretly on military purpose such as trajectory calculation and Cryptanalysis
- How fast?





http://www.infonet.co.jp/ueyama/ip/history/eniac.html (Japanese)

Hardware Architecture



- Control Architecture operates those transaction
- Operating System shares those devices

Operating System

- Main program
  - Manages and launches other programs
  - Also helps with managing files, etc
- History of OS
  - MVS/CMS: OS for IBM Mainframe
    - Multiple Virtual Storage
    - Conversational Monitor System
    - System/360(1964) has established Mainframe features
  - UNIX: Typical workstation OS
  - MS-DOS: De facto standard of OS on early PCs
  - Windows, MacOS: Main OS on current ones
  - LINUX: UNIX for PC
  - Android/iOS for smartphones

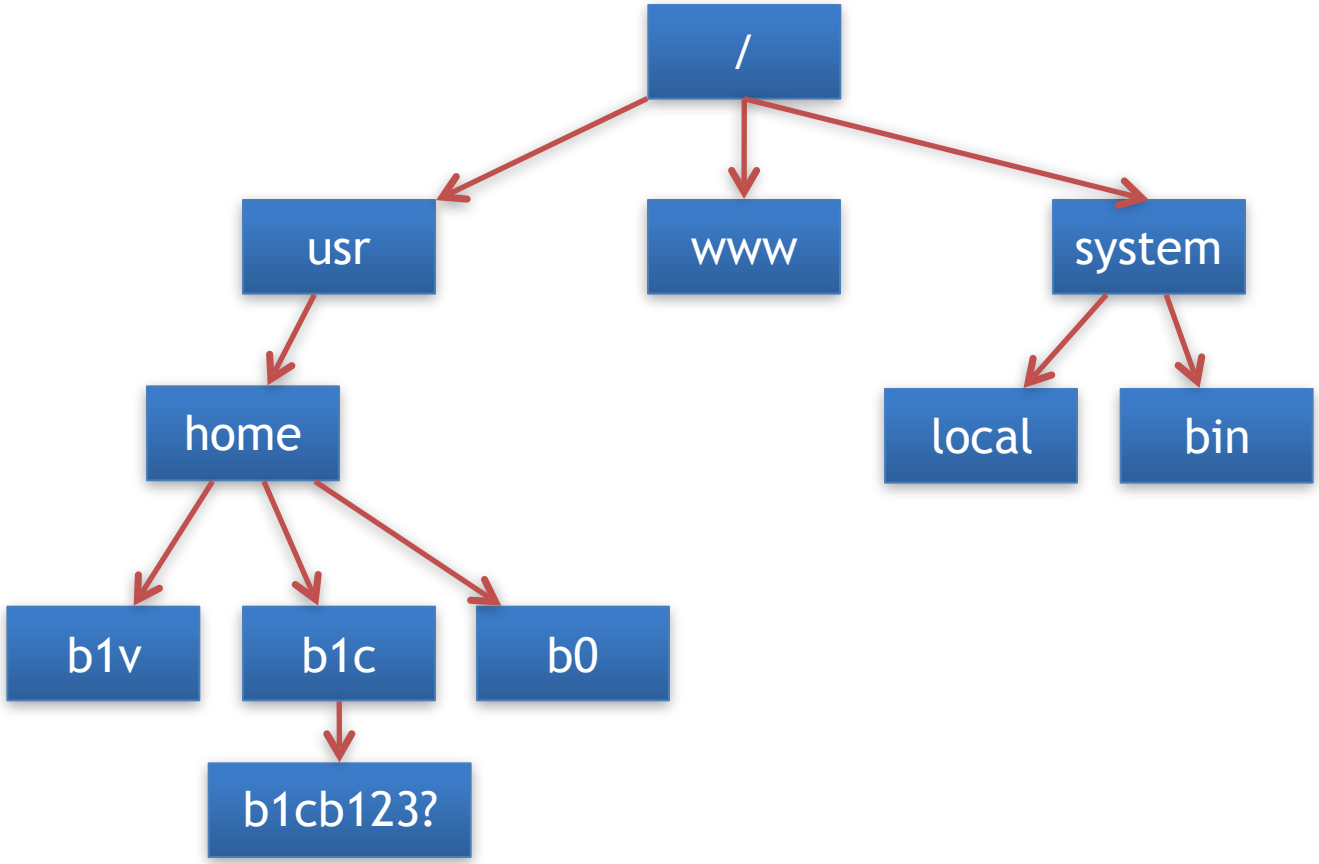
Files and Folders

- File
  - A block of information
    - Document
    - Program
    - Image (a picture from a digital camera)
    - Audio (ex: a song in CD)
    - Movie
    - etc
  - tThe size (amount of storage needed) is measured in Bytes
    - KiloByte (1000), MegaByte, TeraByte … etc

Folders

- Folder (“Directory” in Linux)
  - A virtual container to group files and other folders
  - ex)
    - Music folder which contains audio files
    - “My Documents” or “Home Directory” in your account at Tohoku University
  - Common file system in almost all operating systems

File Structure



Why tree structures?

- Tree structure is needed to handle large data
  - I have more than 1000,000 files in my own PC
  - We have more than 1000,000,000 web pages in the world
  - How to organize them?? Tree is the solution.
    - www.dais.is.tohoku.ac.jp/~tokuyama/profile.htm
  - By using a tree with 6 layers with 20 branches at each node, how many information can be represented?

What is file name?

- File name consists of name and extension
  - Doc1.txt
- Extension is a type of file
- Some applications use their own extensions
  - mytext.txt (text file)
  - mydocument.doc (MS Word 97-2003 document file)
  - mydocument.docx (MS Word 2007- document file)
  - myweb.html (html file: for web design)
  - mypicture.jpg (picture file)

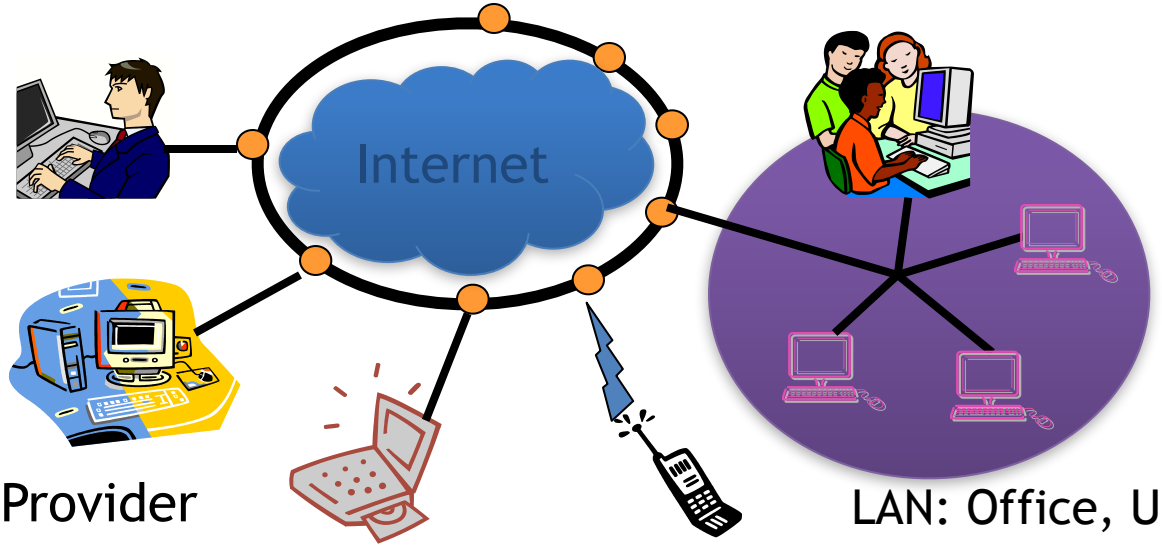
Basic File Operations

- Open “MyDocument” from icon
- Create folders below
  - practice
  - assignment
  - handout
- Move files from folder to another folder
- Create file and copy them

COMPUTER BASICS II
INTERNET

Internet

- Big network connecting many computers
- Networks in home, office and School reach the internet through a provider.



Internet

- History of the Internet
  - 1970s: Development on packet communication and TCP/IP(Transmission Control Protocol / Internet Protocol)
  - 1980s: ARPANET(Pentagon and UC Berkley)
    - Academic, Military, Aviation, Space Development
    - IBM VNET: Corporate network
  - 1990s: Practical Internet based on e-mail
    - Alternative communication method to mail and phone
    - For hearing-impaired person (MCI VIntonCerf)
  - 1990s latter half: www(world wide web)
    - one-to-many multimedia information service on web page
    - Development exceeding TV
  - 2000s: smartphones

Internet

- WWW(World Wide Web)
  - Multicasting information service
    - Open to everybody: one-to-many
    - User select information he/she needs
  - We use search engines to find information
    - i.e. google
  - Links between texts with Hypertext
  - Visualization on Internet Browser
  - Other applications (Mail, RSS, svn, etc)

Internet

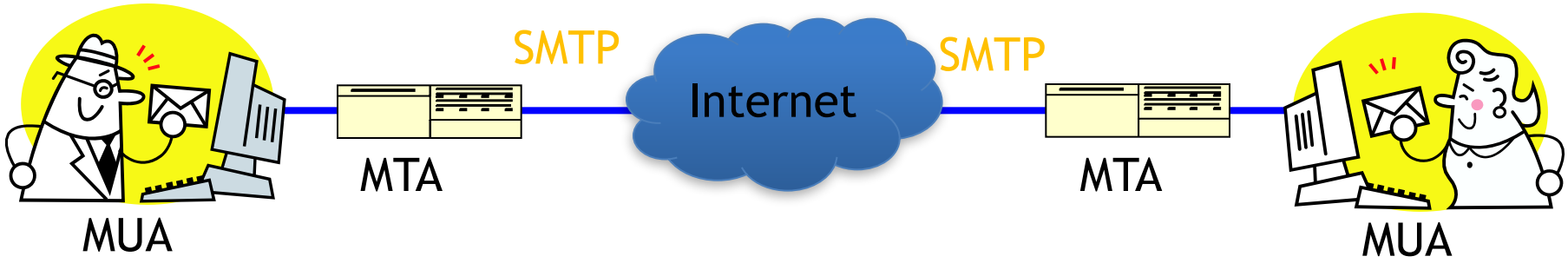
- IP address(Internet Protocol Address)
  - Used identify a machine on network
  - Each computer has a different address
  - Four numbers separated with dots
    - Ex) 192.168.0.1
  - Provided by an agency in each country
    - JPNIC(Japan Network Information Center)

Internet

- Domain names
  - cs.he.tohoku.ac.jp
  - http://www.ise.he.tohoku.ac.jp
- Domain name Servers (DNS) convert IPs to names to make it easier to remember
- More robust to webpage failure, split load, …

E-mail

- System to send messages between people



  - MUA(Mail User Agent)
    - Mailer
  - MTA(Mail Transport Agent)
    - Program on mail server
  - SMTP(Simple Mail Transport Protocol)

E-mail

- Mail Address
  - Consists of user name and domain name

    b1xxxxx@cs.he.tohoku.ac.jp

  - Domain
    - Indicates address of mail server
    - Name of university or company
    - Easy to find (using “DNS”)

情報基礎B (Computer Literacy)
Lecture 4: Databases and Spreadsheets

Matias Korman

Tohoku University Graduate School of Information Sciences
System Information Sciences
Design and Analysis of Information Systems

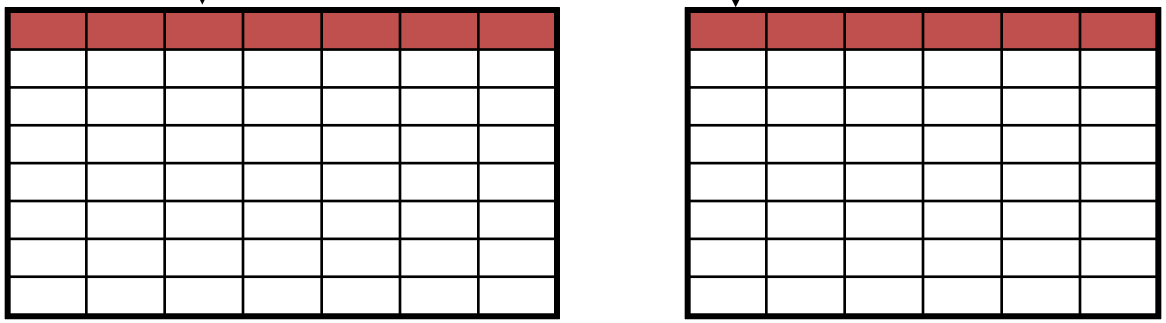
Databases

- Database
  - System to store and organize large amount of data
  - Need good methods to use (search and extract)
  - Address book, Music database, University Library, DNA database, Criminal Records, …
- Operation
  - Data collection
  - Database construction
  - Data management
    - Storing data, search, modify
  - Data analysis and understanding
- Major database structures
  - Relational Database, Functional Database, XML Database

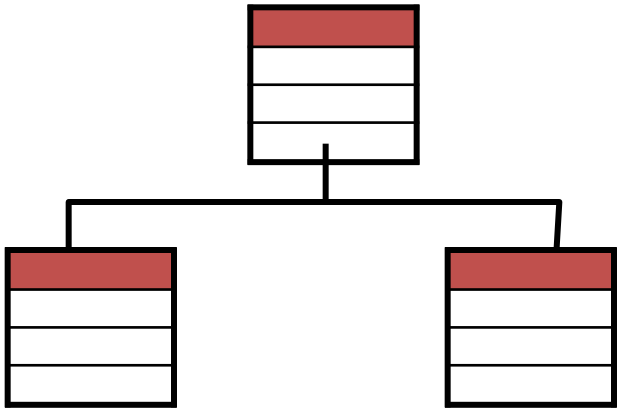
Database model

Relational database model

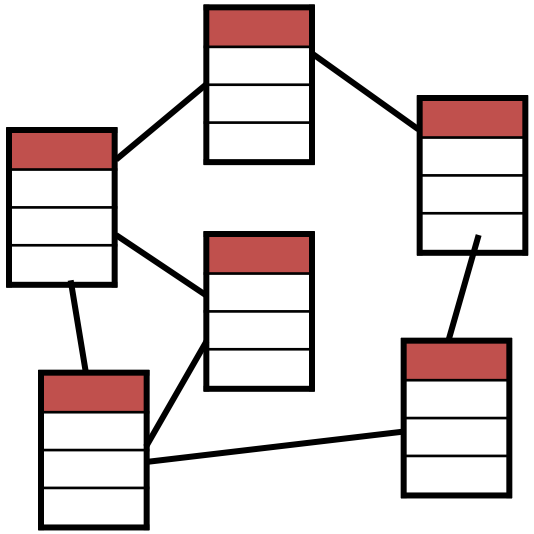
Link tables



Hierarchical database



Network



Relational Databases

- Based on the theory of relational data model proposed by Edgar F. Codd in IBM(1970)
- Each Table contains information of one type (say students, courses)
- Combine information with IDs (i.e., student 24 obtained a C score in course 12)
- SQL (Structured Query Language) used to obtain and modify information

SELECT Math ≧ 80 AND English ≧ 90 FROM Exam;

Example of Relational Database: Sales Database

Sales: 2010Jan

	Item1	Item2	Item3	Item4	Item5	Item6	Item7	Item8	Item9	Item 10
Hokkaido	136	84	192	102	174	73	51	76	84	105
Aomori	127	122	63	70	35	224	75	246	230	253
Iwate	24	225	120	214	170	142	252	80	253	124
Miyagi	147	62	172	58	218	75	208	224	161	111
Akita	99	221	148	188	140	69	184	78	172	204
Yamagata	143	157	184	105	166	129	78	206	164	189
Fukushima	148	99	105	49	253	63	102	113	163	185
Ibaraki	49	62	240	51	107	223	147	199	107	140
Tochigi	64	159	191	24	120	215	210	249	123	54
Gunma	59	87	131	211	83	249	36	221	263	138
Saitama	92	131	99	193	240	105	184	52	74	144
Chiba	118	58	60	46	245	206	93	240	55	153

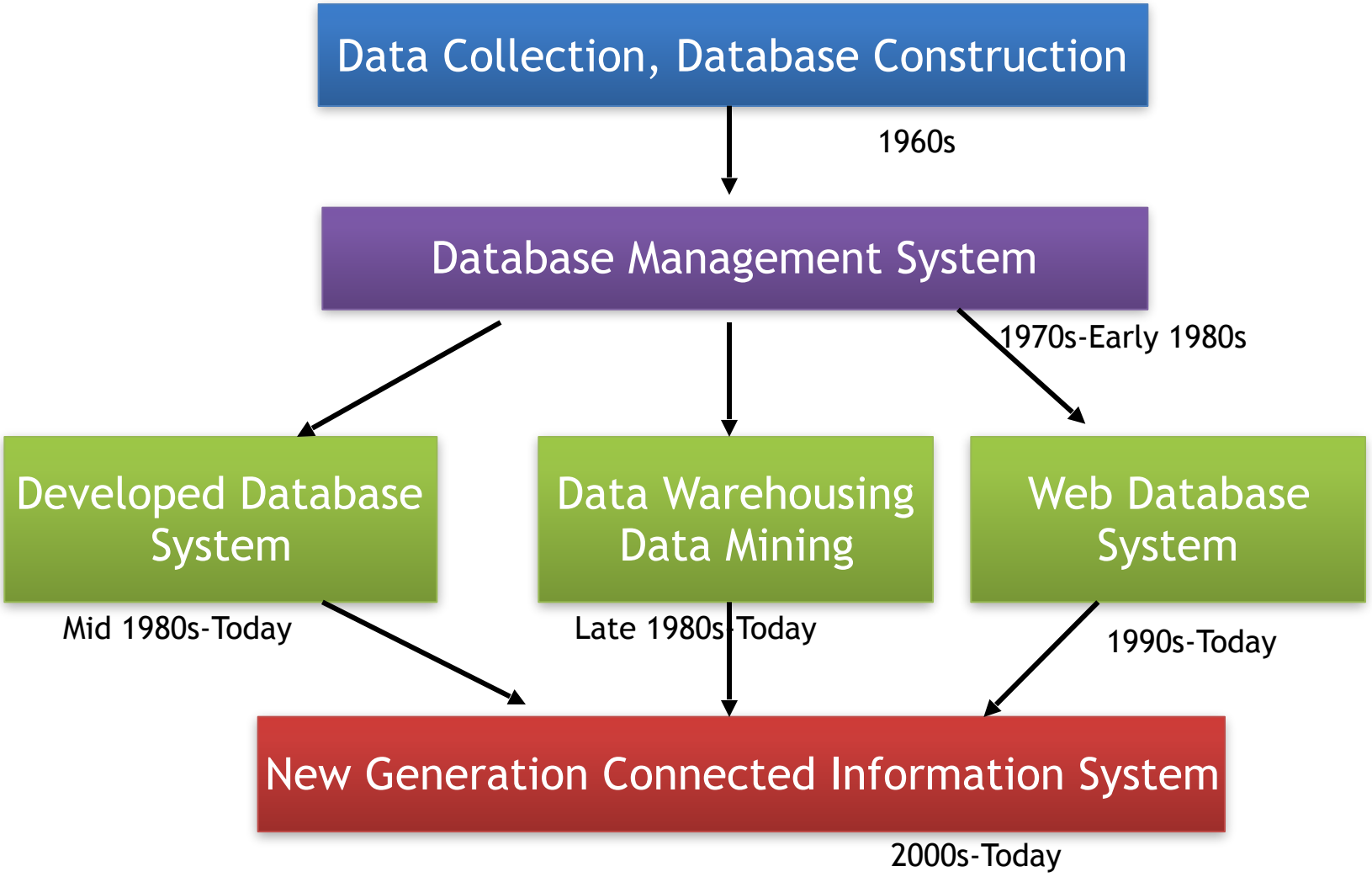
Sales: 2010Dec

	Item1	Item2	Item3	Item4	Item5	Item6	Item7	Item8	Item9	Item 10
Hokkaido	110	218	85	133	25	33	117	111	233	65
Aomori	145	89	31	141	104	217	88	99	36	263
Iwate	126	29	79	70	155	113	144	211	128	236
Miyagi	108	92	263	100	249	134	52	72	208	163
Akita	152	113	33	41	153	48	147	130	79	201
Yamagata	150	93	115	166	120	46	260	77	113	54
Fukushima	206	256	109	60	230	61	157	238	117	82
Ibaraki	220	263	140	250	225	30	246	171	150	25
Tochigi	153	118	57	42	186	197	182	111	85	225
Gunma	237	87	137	129	199	151	128	115	163	214
Saitama	176	58	82	86	268	158	191	234	70	216
Chiba	116	58	175	237	103	72	34	165	37	101

Prices

	Item1	Item2	Item3	Item4	Item5	Item6	Item7	Item8	Item9	Item10
Cost price	874	574	785	250	184	385	456	784	890	458
Selling price	980	870	900	500	354	450	980	800	980	650

Development of Database Technology

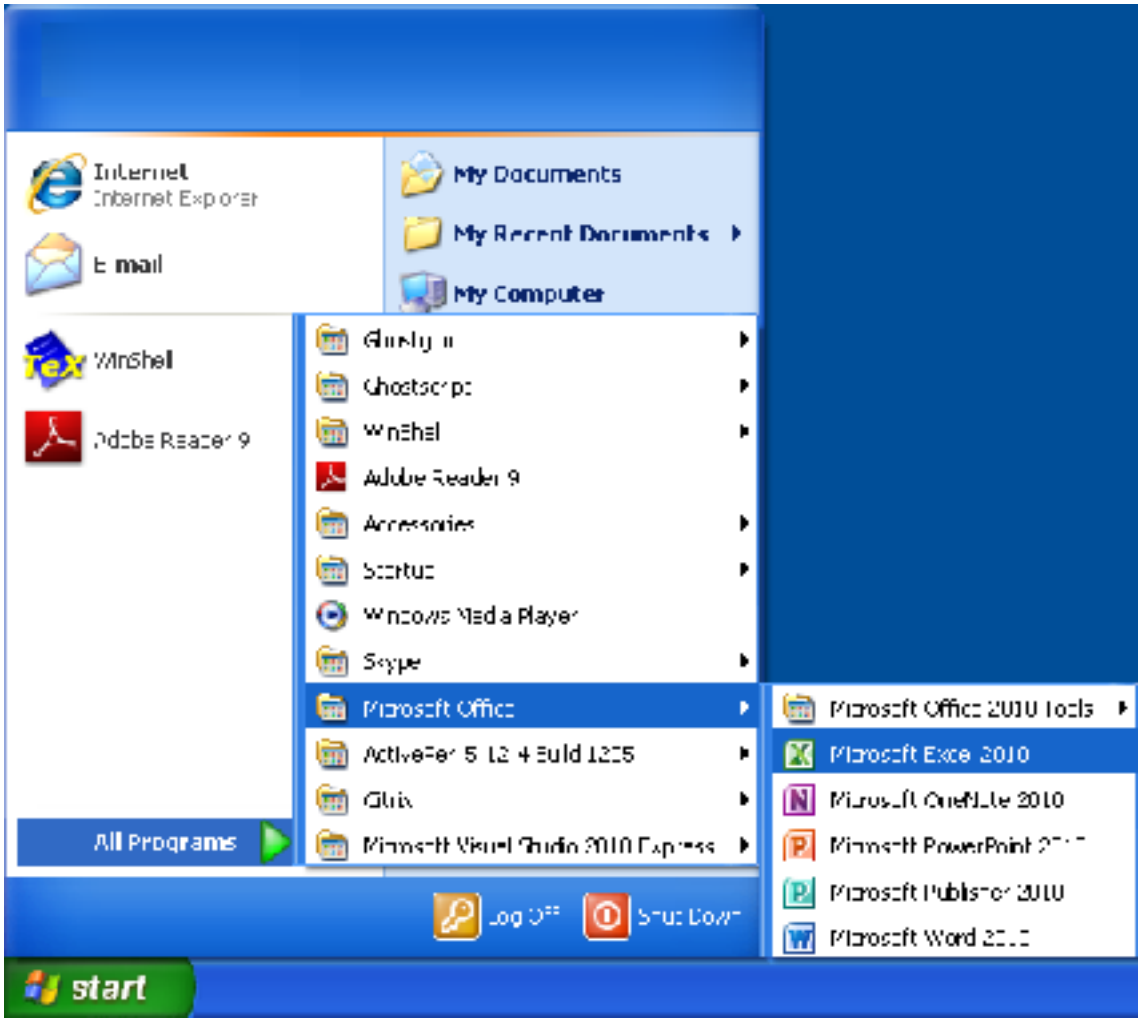


Using EXCEL

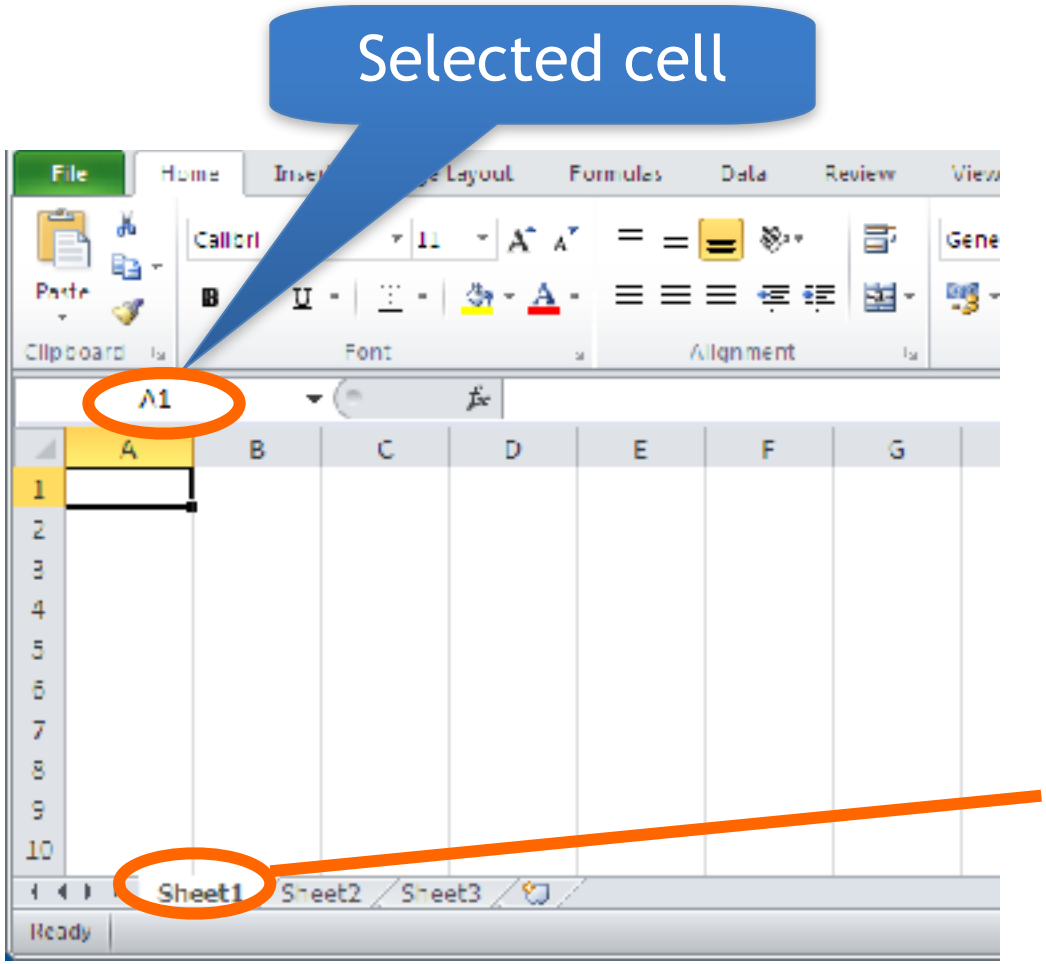
- Application software of Microsoft
- Data is stored in spreadsheets (idea from the 1960th)
  - VisCalc on Apple II (1979) changed the use of PC
- Specialized for data analysis
  - Calculation
    - Simple calculation
    - Math Functions
  - Data to graph
  - Data collection to Database(small DB)
  - Numeric data, character data
- Programming with VBA
  - Software programming
    - Accounting software, game and etc

Open Excel

Start
↓
All Programs
↓
Microsoft Office
↓
Microsoft Office Excel 2010

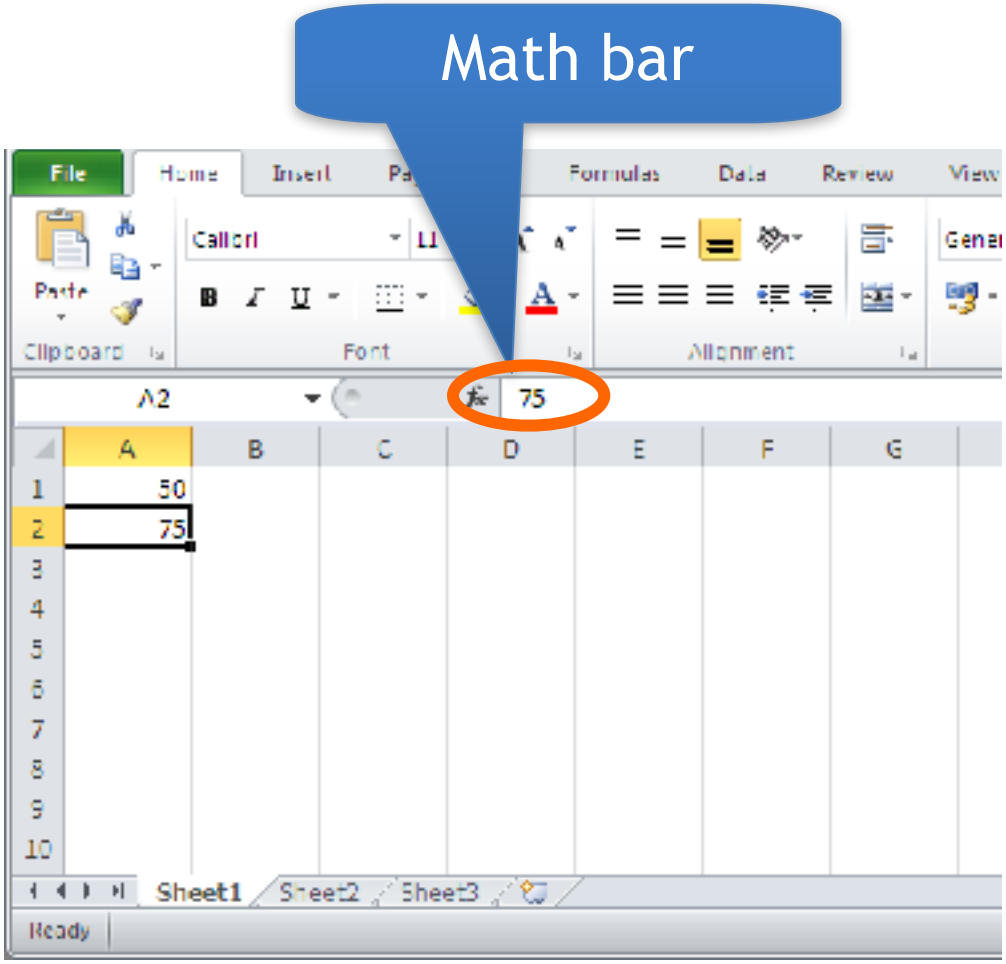


Entering Data



- Select a cell and type
- Active cell
- Cell number
  - A1, C2
    - Column
      - A, B, C, D, …
    - Row
      - 1, 2, 3, 4, …
- Sheets separate info
  - Sheet index
    - Sheet1

Entering Data



- Editing is shown in the math bar

Simple Calculation

- Data can be simple or derived
  - A1 50
  - A2 75
  - A3 5
  - A4 8
  - A6 =A1+A2
  - A7 =A2-A3
  - A8 =A3*A4
  - A9 =A1/A3
  - A10 =(A1+A3)*A4 – (A2+A4)/A3

Other Math Operators

- Sum
  - E1 =A1+A2+A3+A4
  - E2 =sum(A1:A4)
- Average
  - E3 =(A1+A2+A3+A4)/4
  - E4 =E1/4
  - E5 =average(A1:A4)
- Max, Min
  - E6 =max(A1:A4)
  - E7 =min(A1:A4)

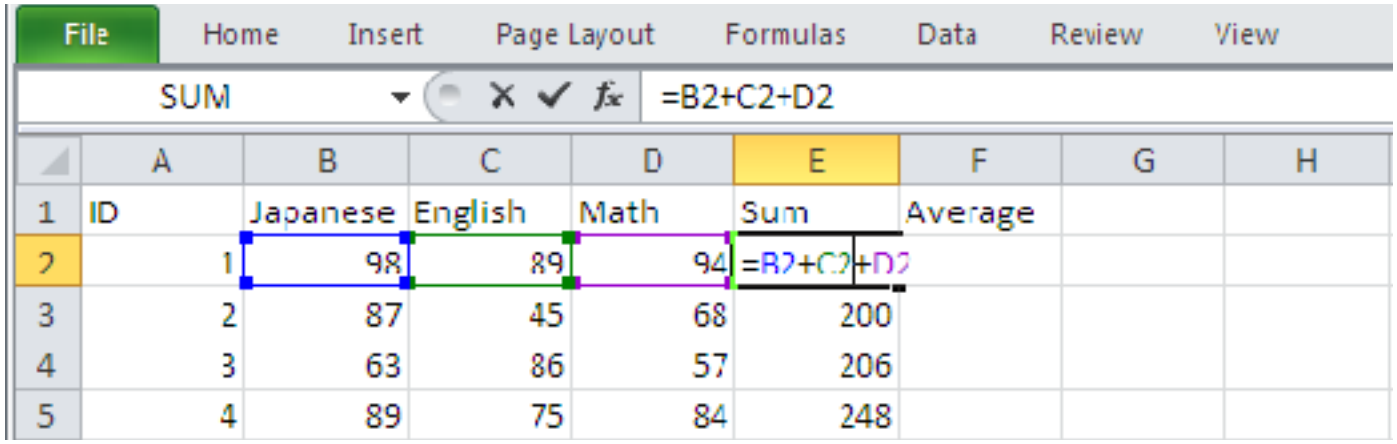
Simple Exercise Grade students

- Create Exam Data
  - Items
    - ID and 3 courses (Japanese, English, Math)
  - 10 students (1, 2 ,…, 10)

Or download from my webpage

Let’s compute the Average, Total Score and best score of each student!

Sum



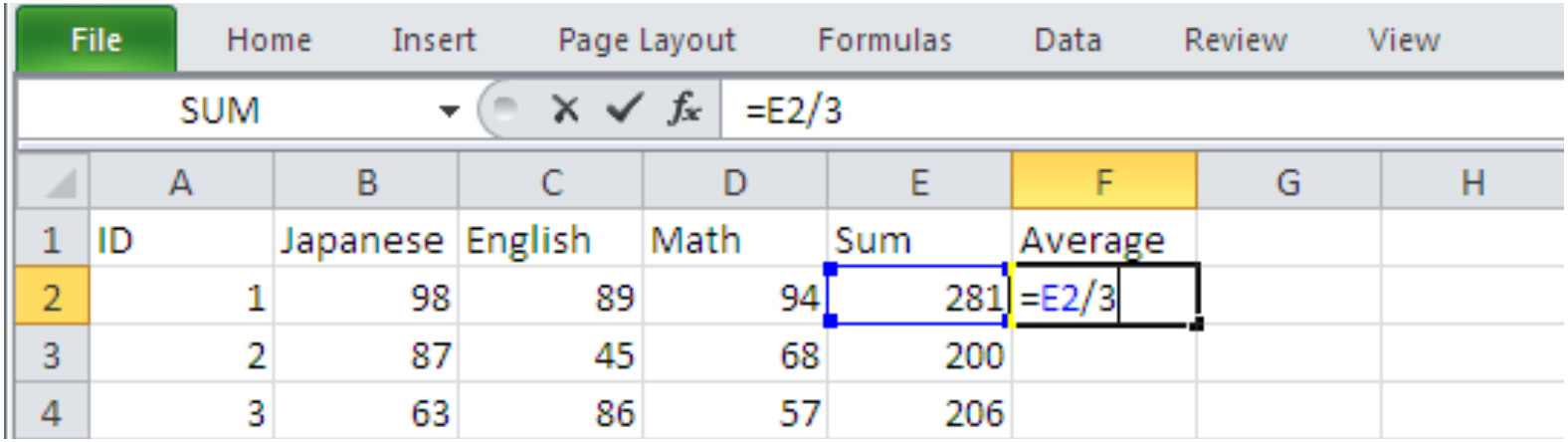
	A	B	C	D	E	F	G	H
1	ID	Japanese	English	Math	Sum	Average		
2	1	98	89	94	=B2+C2+D2			
3	2	87	45	68	200			
4	3	63	86	57	206			
5	4	89	75	84	248			

- Enter a formula below

=B2+C2+D2

Sheet: simplecalc

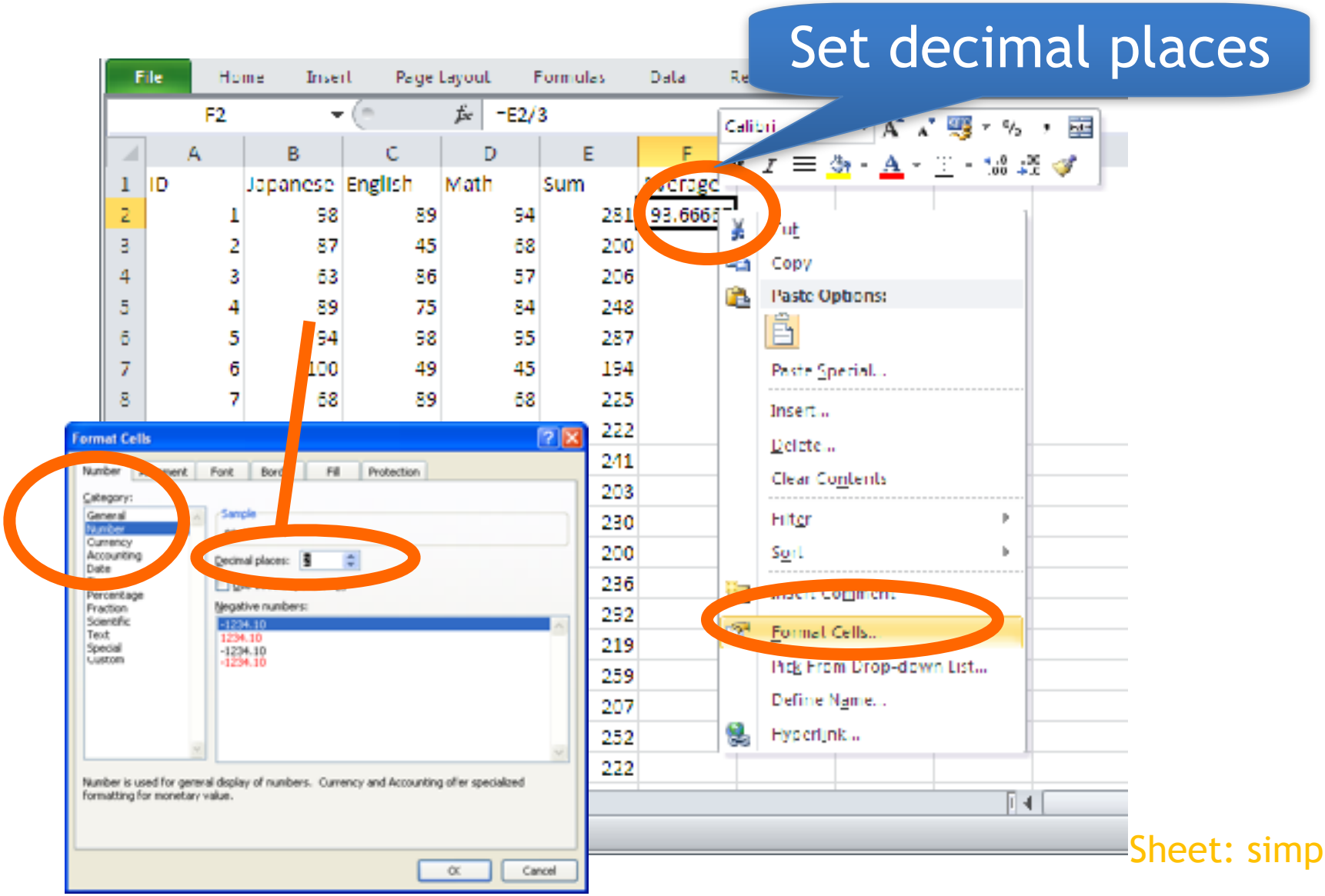
Average



=E2/3 or =(B2+C2+D2)/3

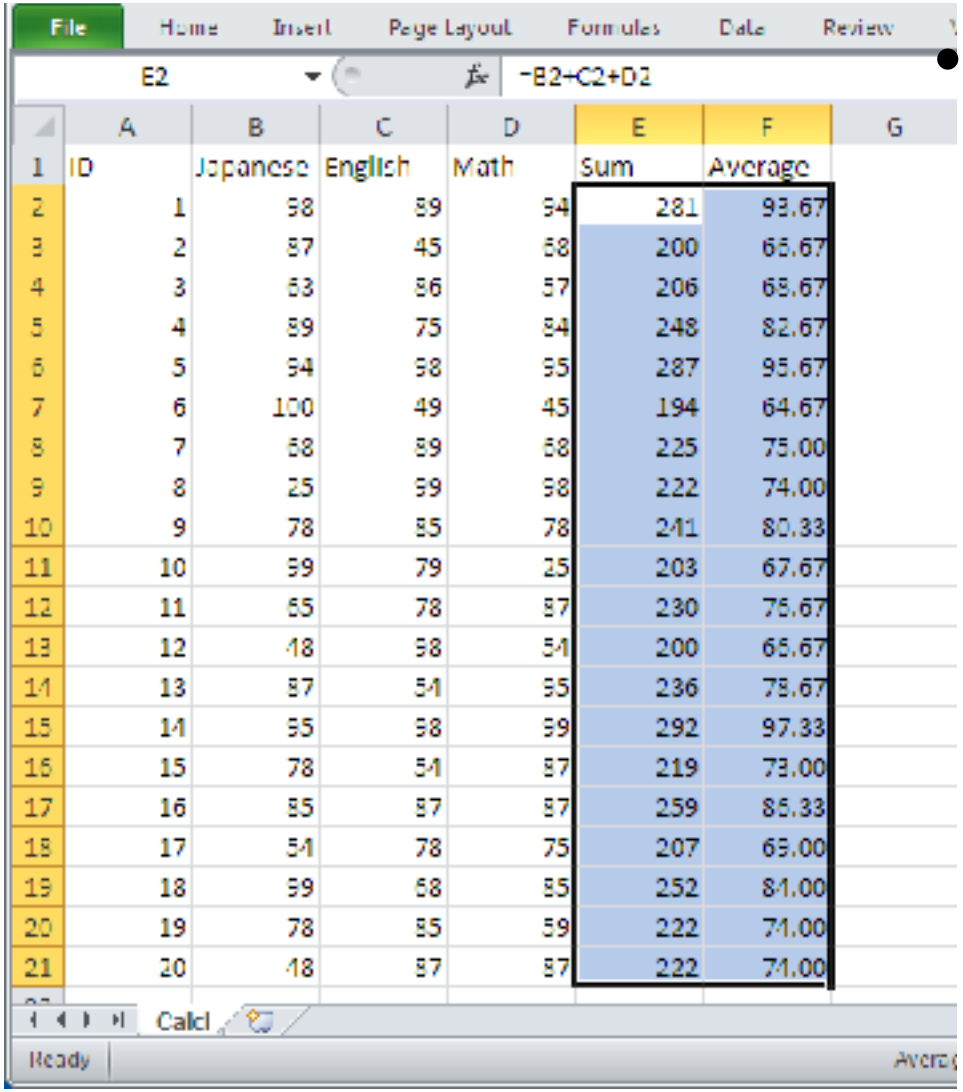
Sheet: simplecalc

Beware of cell format!



Sheet: simplecalc

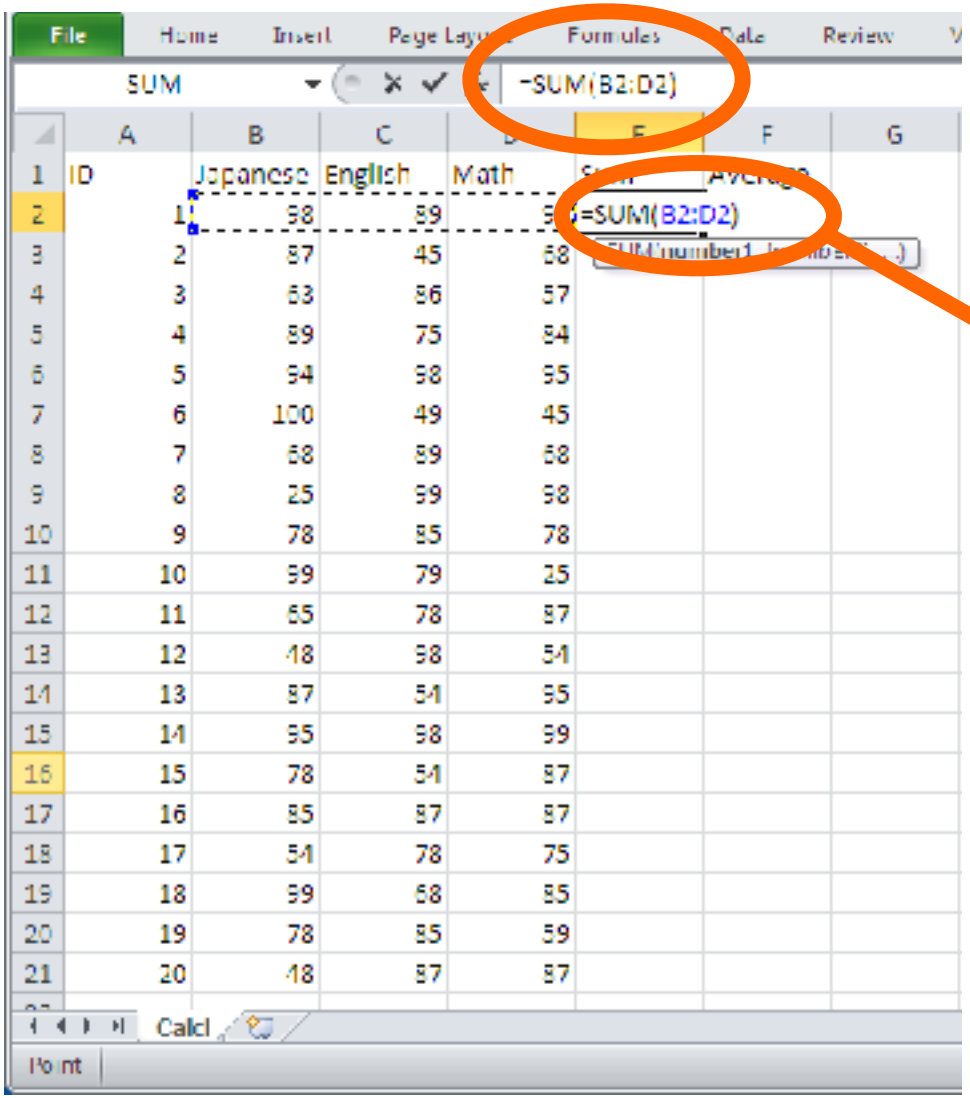
Copying Cells



	A	B	C	D	E	F	G
1	ID	Japanese	English	Math	Sum	Average	
2	1	98	89	94	281	93.67	
3	2	87	45	68	200	66.67	
4	3	63	86	57	206	68.67	
5	4	89	75	84	248	82.67	
6	5	94	98	95	287	95.67	
7	6	100	49	45	194	64.67	
8	7	68	89	68	225	75.00	
9	8	25	99	98	222	74.00	
10	9	78	85	78	241	80.33	
11	10	99	79	25	203	67.67	
12	11	65	78	87	230	76.67	
13	12	48	98	54	200	66.67	
14	13	87	54	95	236	78.67	
15	14	95	98	99	292	97.33	
16	15	78	54	87	219	73.00	
17	16	85	87	87	259	86.33	
18	17	54	78	75	207	69.00	
19	18	99	68	85	252	84.00	
20	19	78	85	99	222	74.00	
21	20	48	87	87	222	74.00	

- Copy/Paste
  - Your new best friend
  - Formulas are copied and “Translated”
  - Use & To prevent translation

Sum



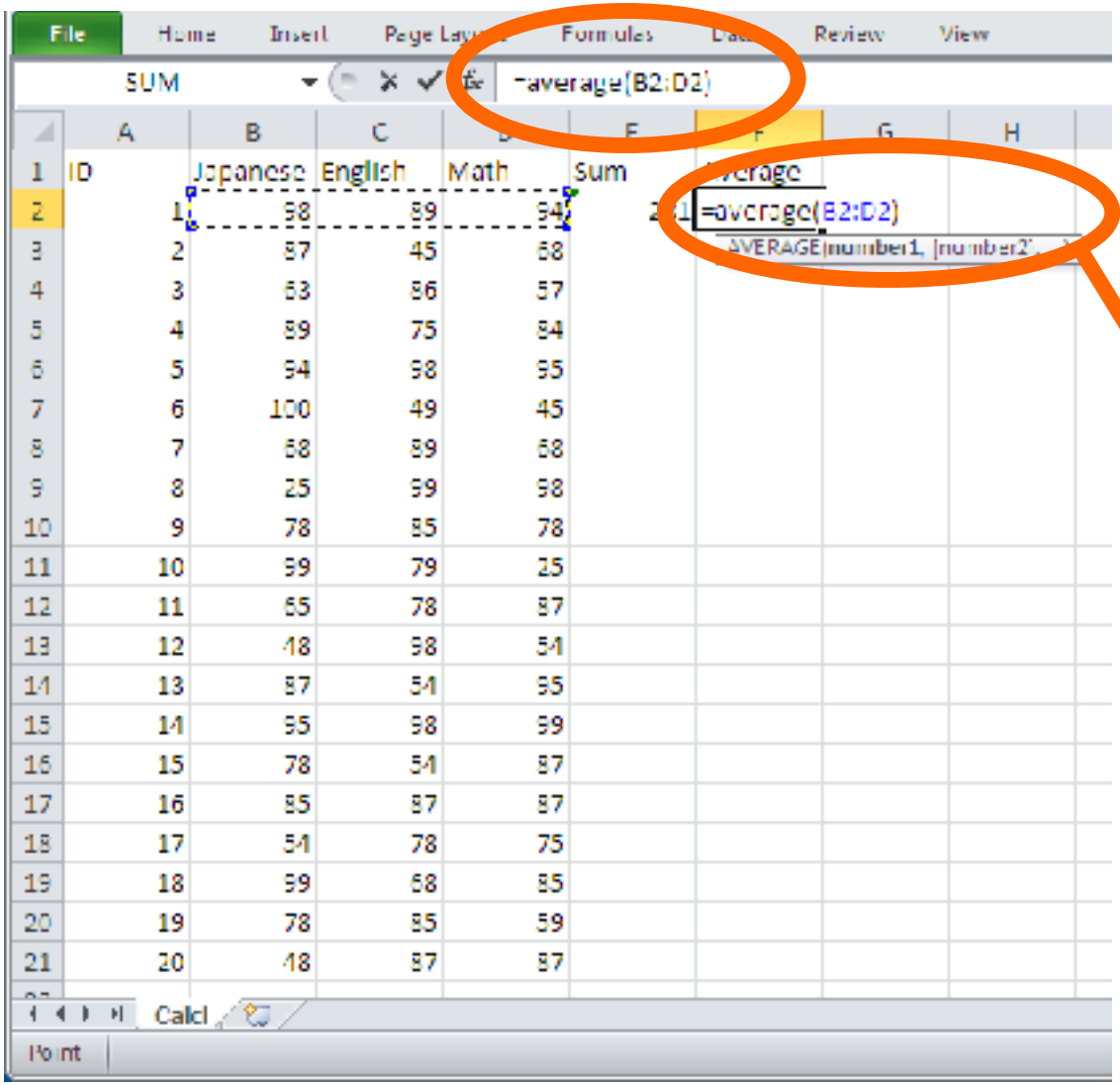
=sum(Cell range)

=sum(B2:D2)

Cell range： B2 to D2

Sheet: mathfunction

Average



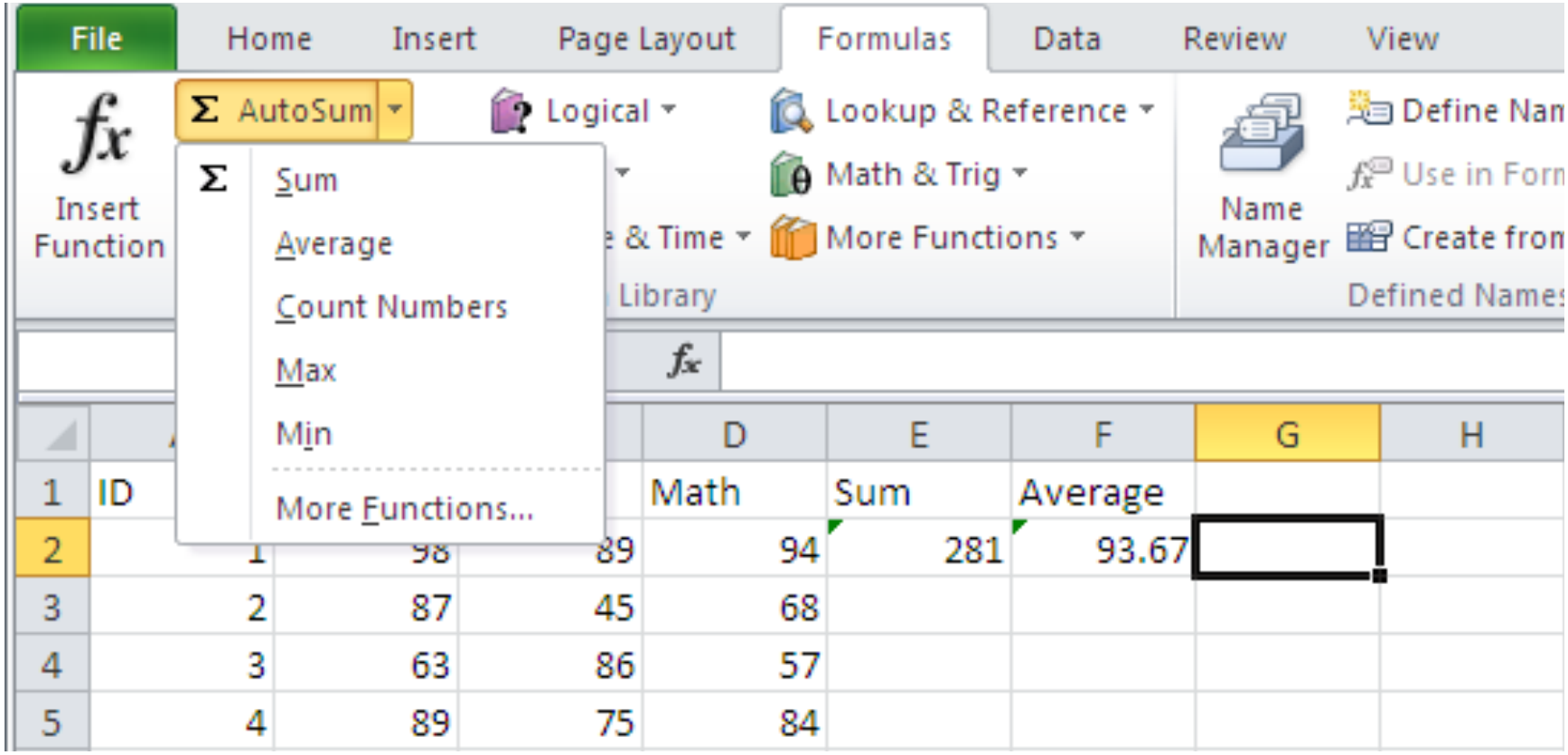
=average(Cell range)

=average(B2:D2)

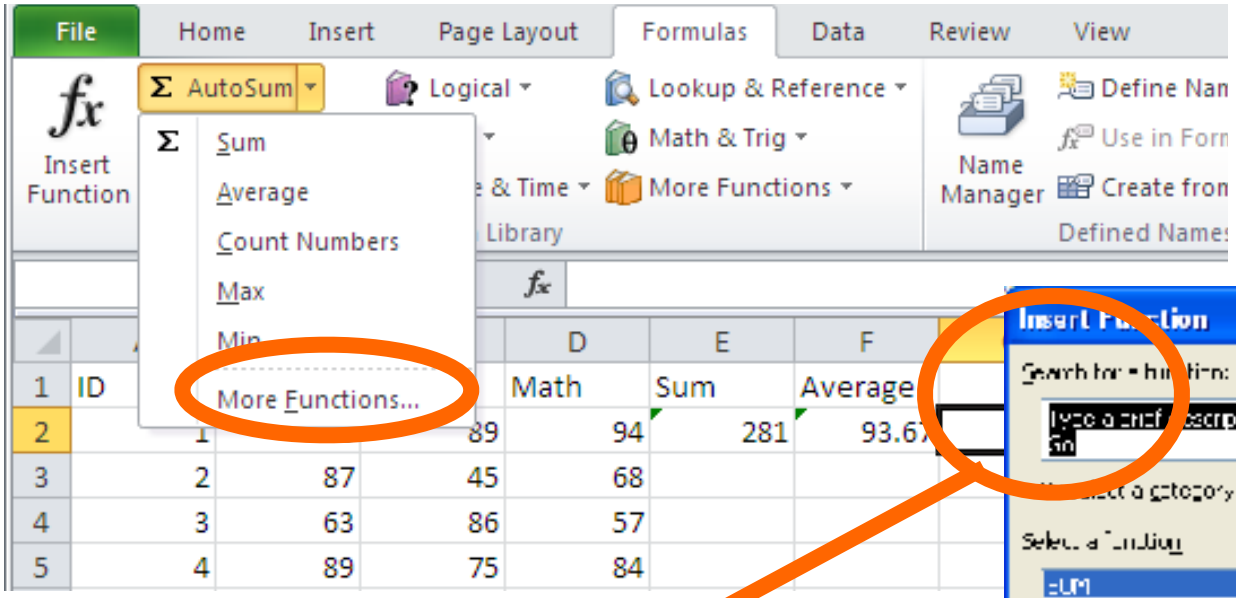
Cell range： B2 to D2

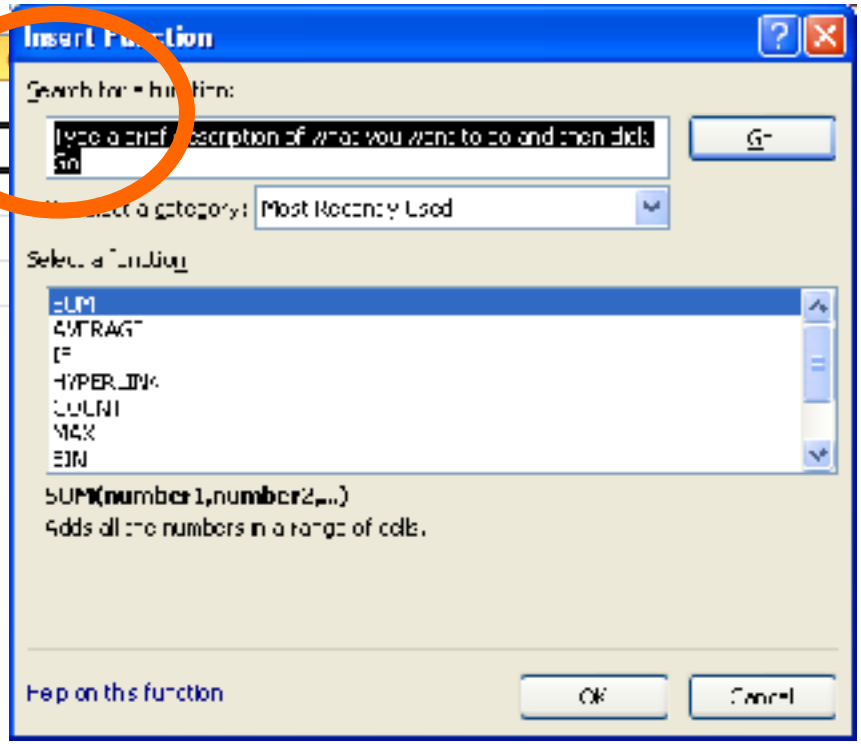
Sheet: mathfunction

Other Math Functions



Other Math Functions





"Search is your friend"

情報基礎B
Lecture 5: Complex formulas

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Tohoku University Graduate School of Information Sciences
System Information Sciences
Design and Analysis of Information Systems

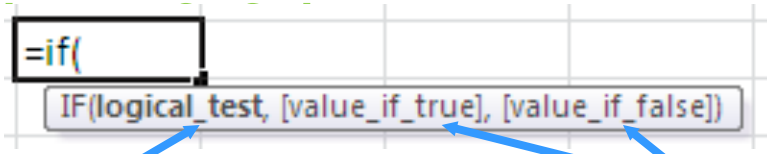
PLAYING WITH SPREADSHEETS

Comparing data

- Comparison
  - A15 =10>3
  - B15 =10<3
  - C15 =(10*2)<3
  - D15 =C1>C2
  - E16 =C7>E2
- Result is “TRUE” or “FALSE”

Interesting programs?

- Branching
  - Action depends on something else
- Implemented with IF function
  - IF(criterion, action1, action2)
    - Proceed action1 when the criterion is true, otherwise proceed action2
  - =IF(logical_test, value_if_true, va



Logical test or cell number

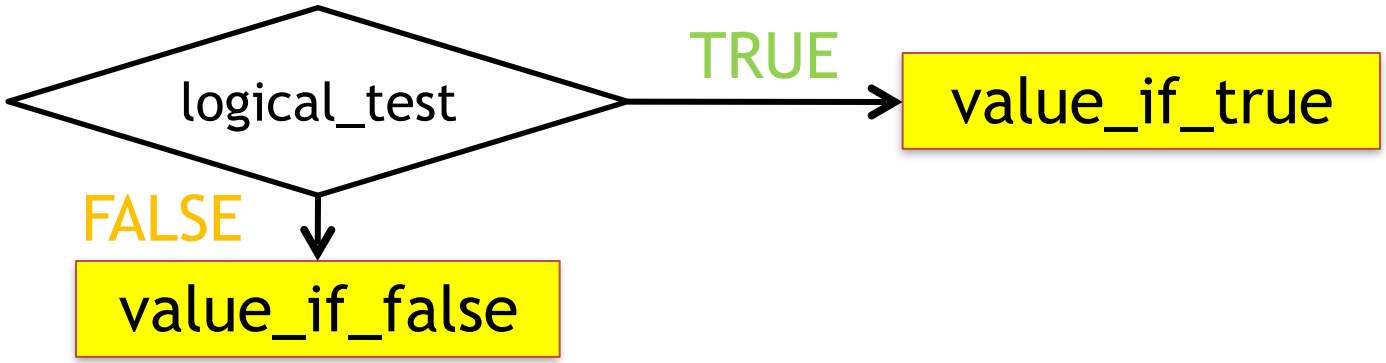
Characters with “” or numbers

Simple Program

- Operators used in logical tests
  - A=B A is equal to B
  - A>B A is larger than B
  - A<B A is smaller than B
  - A<=B A=B or A<B
  - A>=B A=B or A>B
  - A<>B A is not equal to B

Simple Program

=IF(logical_test, value_if_true, value_if_false)



=IF(logical_test, 1, 0)

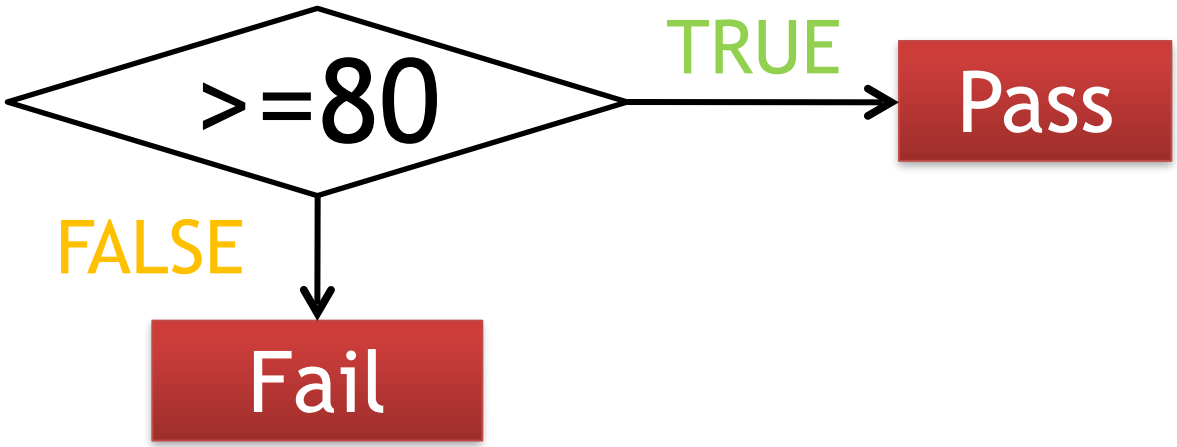
- A16 =IF(A15, 1, 0)

=IF(logical_test, "string", "string")

- B16 =IF(A15, "True", "False")
- C16 =IF(C1>C2, "Correct", "Wrong")

Grading a student

- D16 =IF(A1>=80, “Pass”, “Fail”)

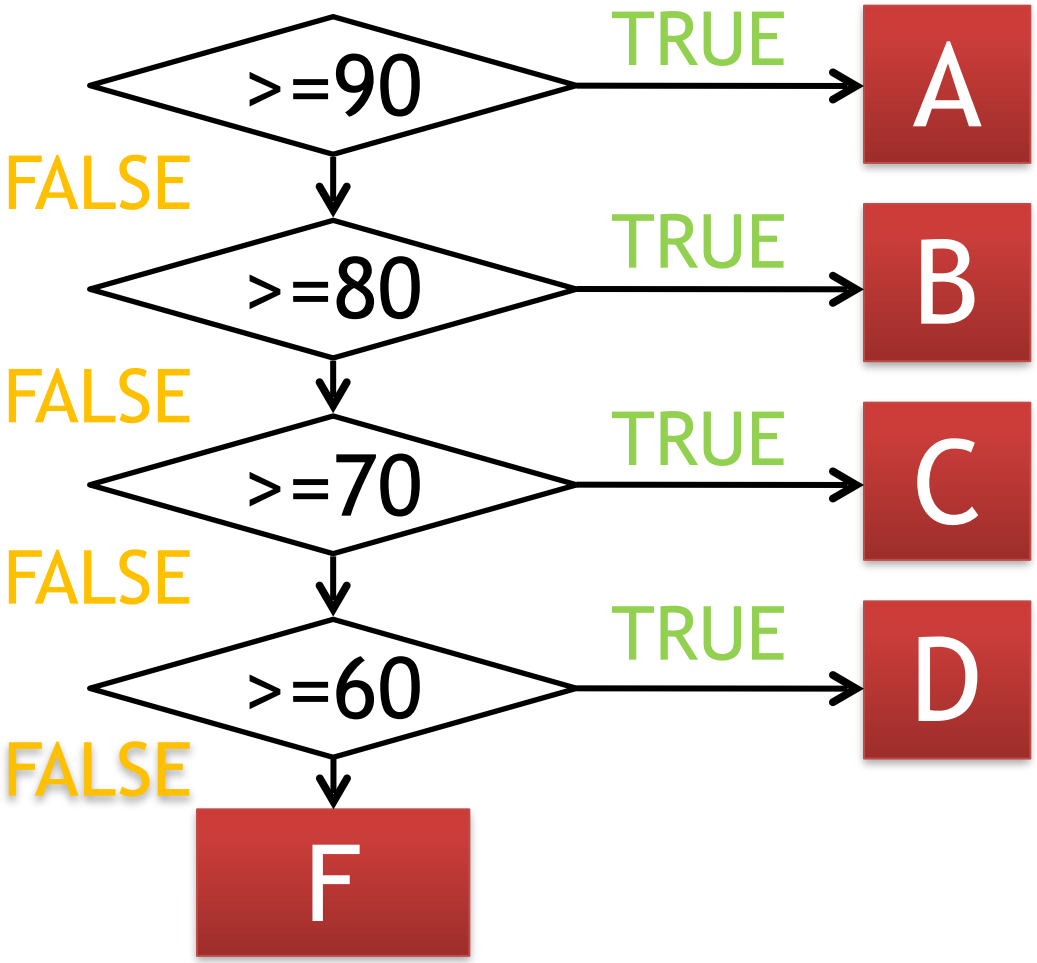


Exercise 1: Coarse grading

- Use table from last week

  download from https://goo.gl/Kks4Bh
- Program a grading system on excel which outputs “Pass” or “Fail”
  - Pass: if Score of Japanese, English, and Math is more than 80
  - Fail: otherwise
  - Add “Result” on G1
  - Same entry for positions G2 to G21

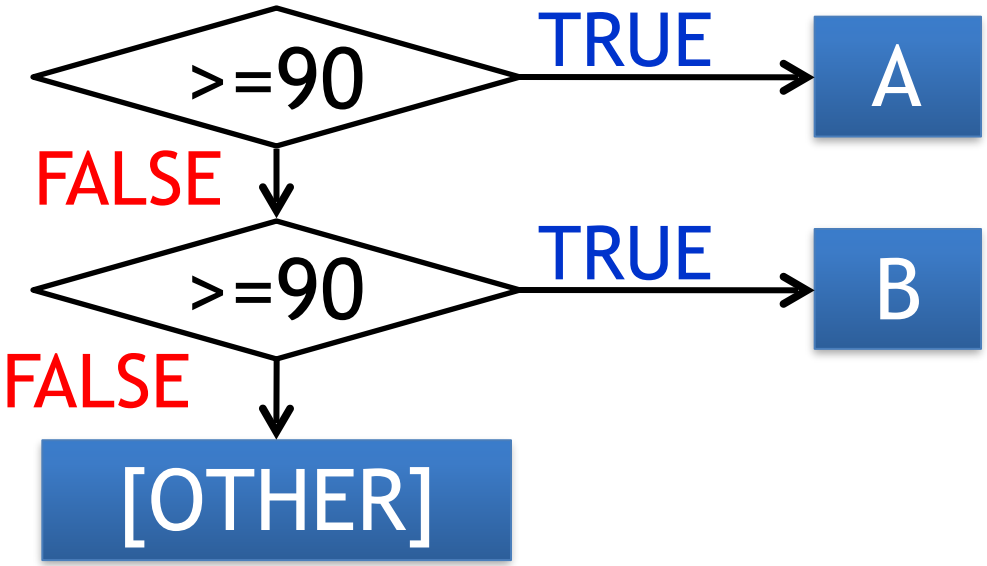
Branching



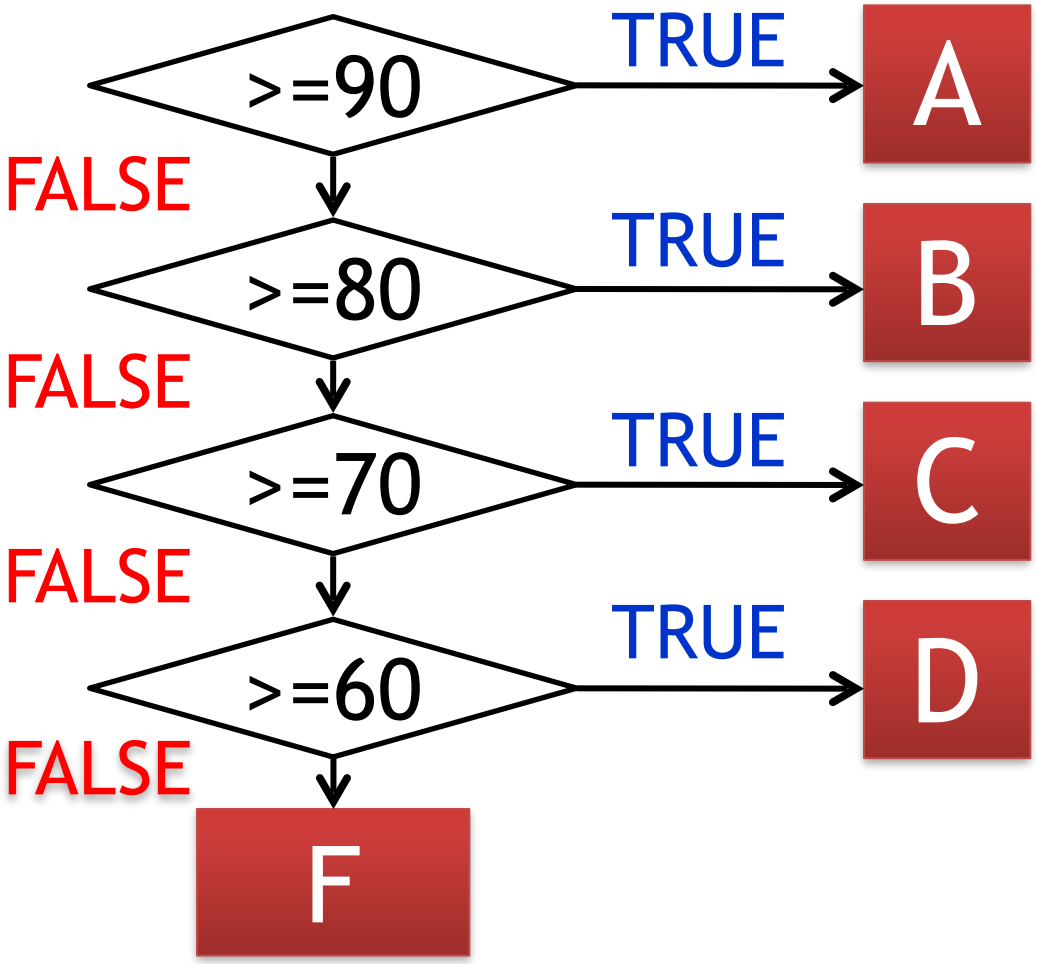
Branching

- Three scores by nesting “IF” operations

```
=IF(B2>=90, “A”, IF(B2>=80, “B”,”OTHER”) )
```



Do we need to stop at 3?



Writing in Excel

- Grade
  - A 100 > Score >= 90
  - B 90 > Score >= 80
  - C 80 > Score >= 70
  - D 70 > Score >= 60
  - F 60 > Score

```
=IF(B2>=90, ”A”,
  IF(B2>=80, ”B”,
  IF(B2>=70, ”C”,
  IF(B2>=60, ”D”, “F”))))
```

Exercise 2: fine grading

- Make a grading system which outputs “A”, “B”, “C”, “D” or “F” for each Subject
  - A　100 > Score >= 90
  - B　90 > Score >= 80
  - C　80 > Score >= 70
  - D　70 > Score >= 60
  - F　60 > Score
  - Apply same method to all students
  - Add “Japanese”, “English” and “Math” header each on G1, H1 and L1

Counting

- How many students got A on Japanese?

=COUNTIF(range, criteria)

=COUNTIF(G2:G21, “A”)

Exercise 3: counting

- Count numbers of students that got each grade in each subject

	Japanese	English	Math
A	6	4	5
B	4	7	6
C	3	4	2
D	3	1	2
F	4	4	5

Exercise 3: counting

- Count numbers of students that got each grade in each subject

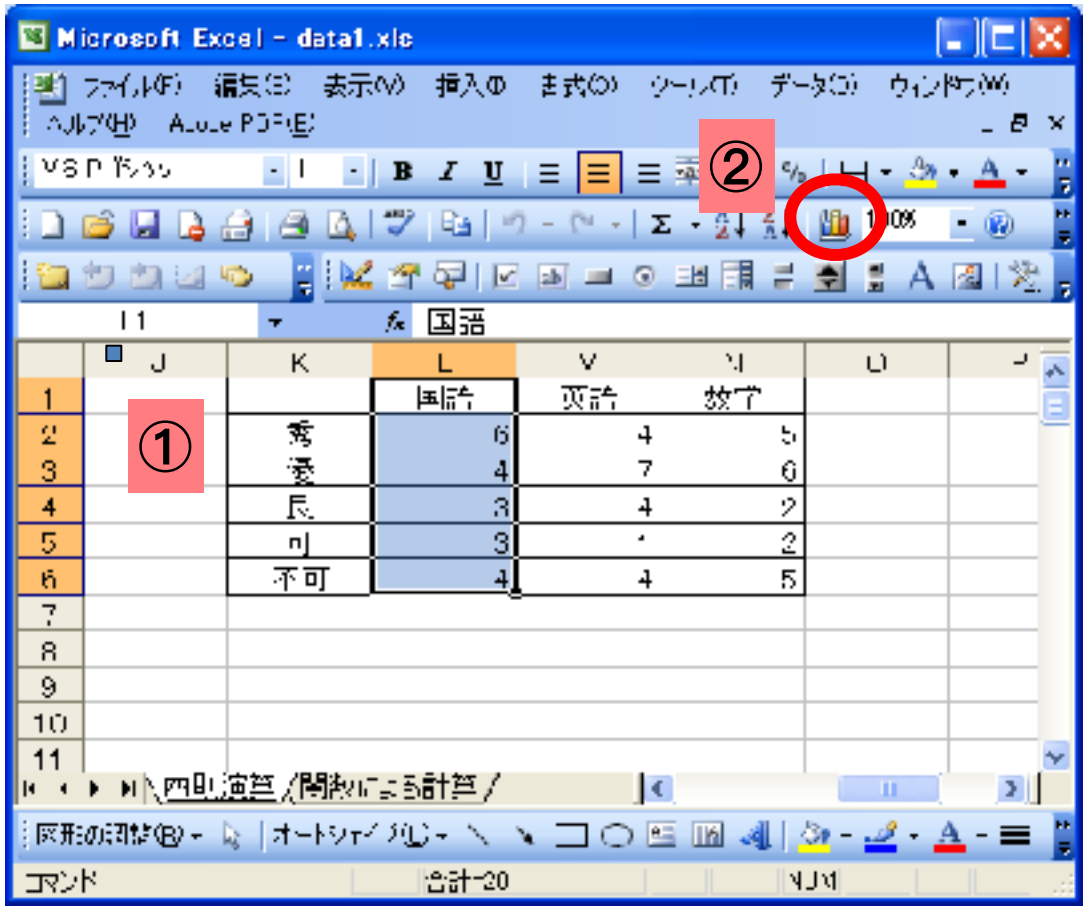
	Japanese	English	Math
A	6	4	5
B	4	7	6
C	3	4	2
D	3	1	2
F	4	4	5
SUM	**20**	**20**	**20**

- Sanity check: totals in each course

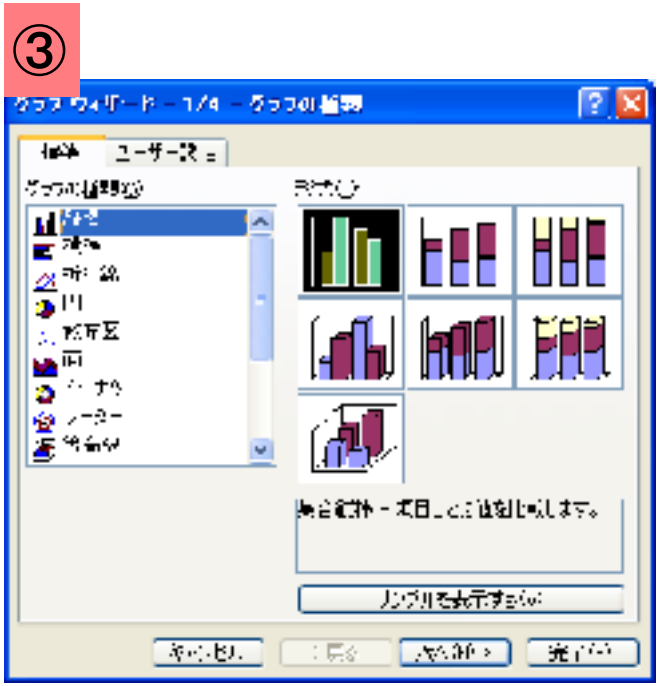
CHARTS

Let’s make pretty drawings!

- Bar chart

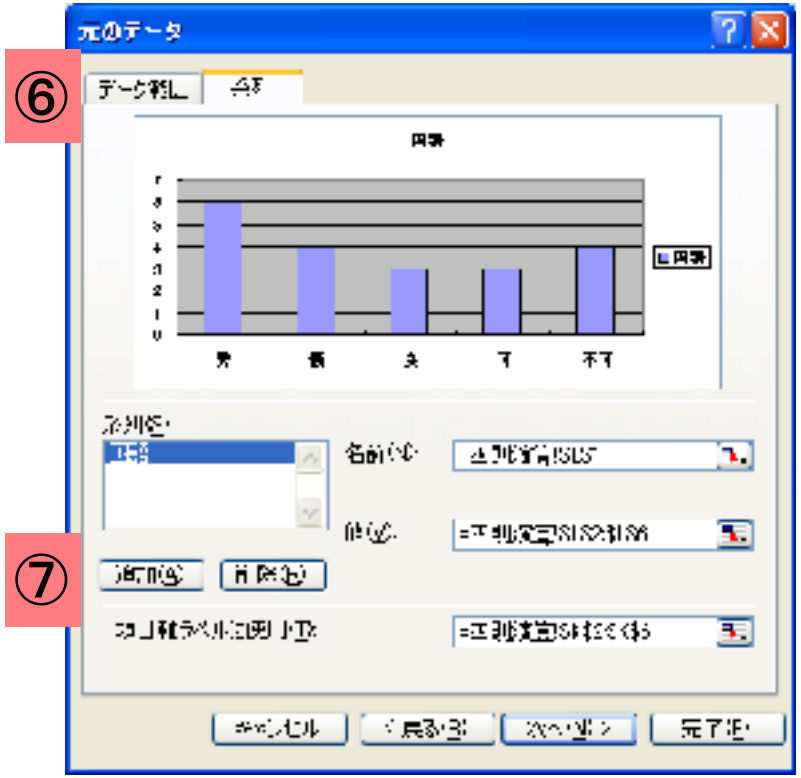


1. Select data range
2. Click “Chart Wizard”
3. Select a chart type



Chart

- Bar chart

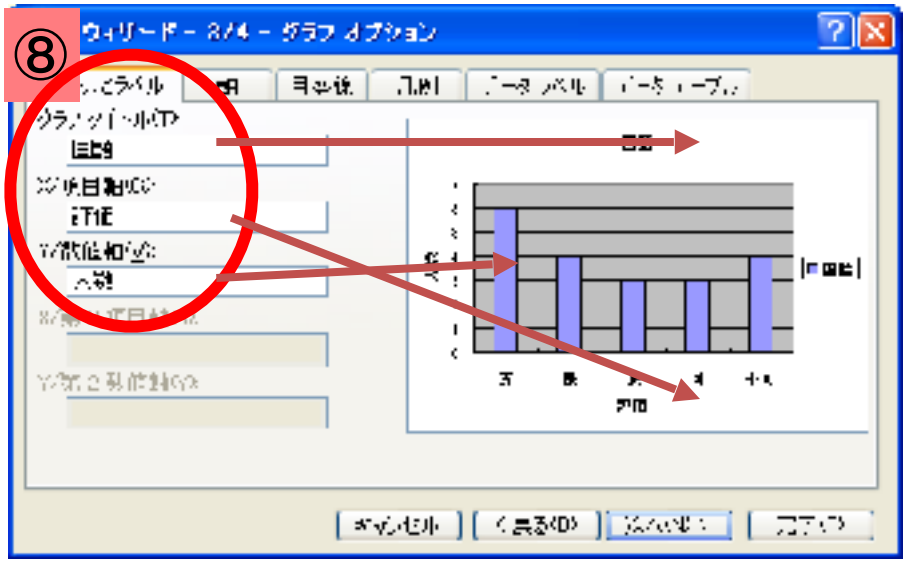


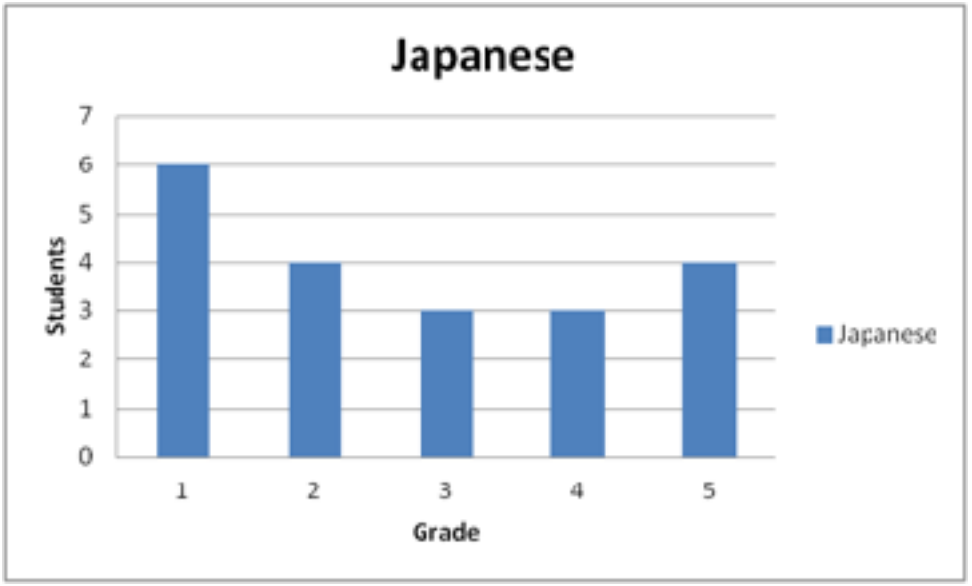
5. Data range is shown. Or enter a range directly

6. Select “Series”
7. Set Category (X) axis labels

Chart

- Bar chart

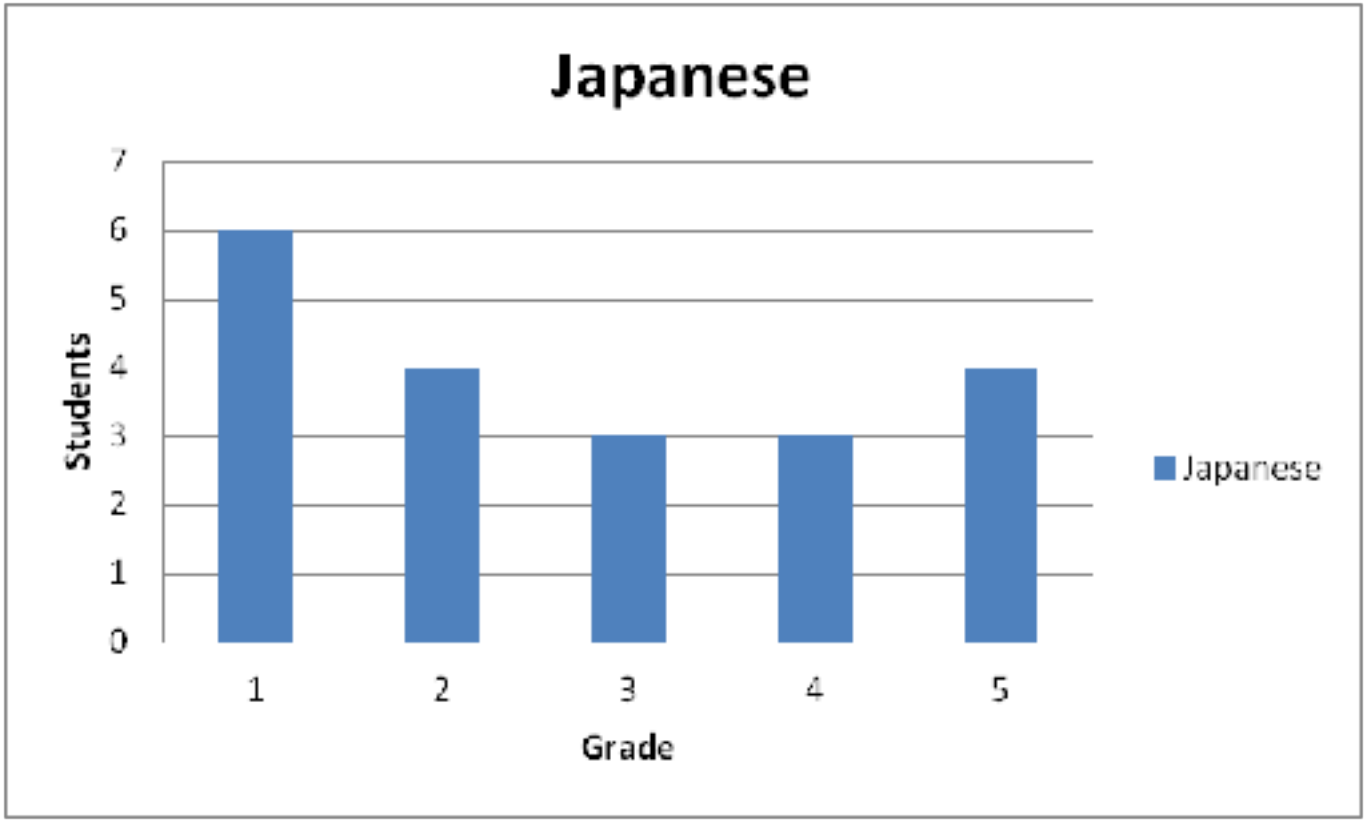




8. Enter chart title and label for category and value

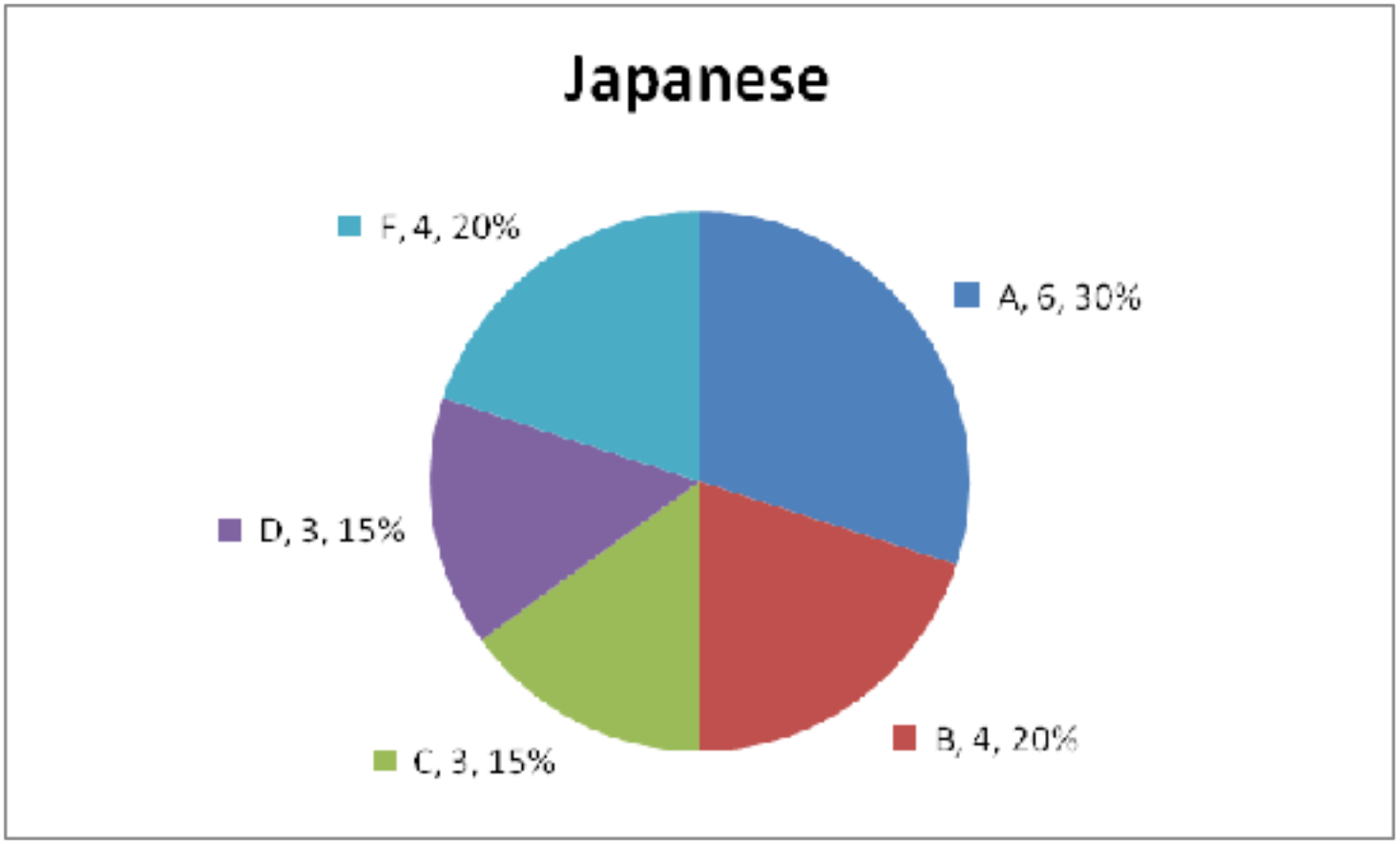
Many different charts

- Bar Chart



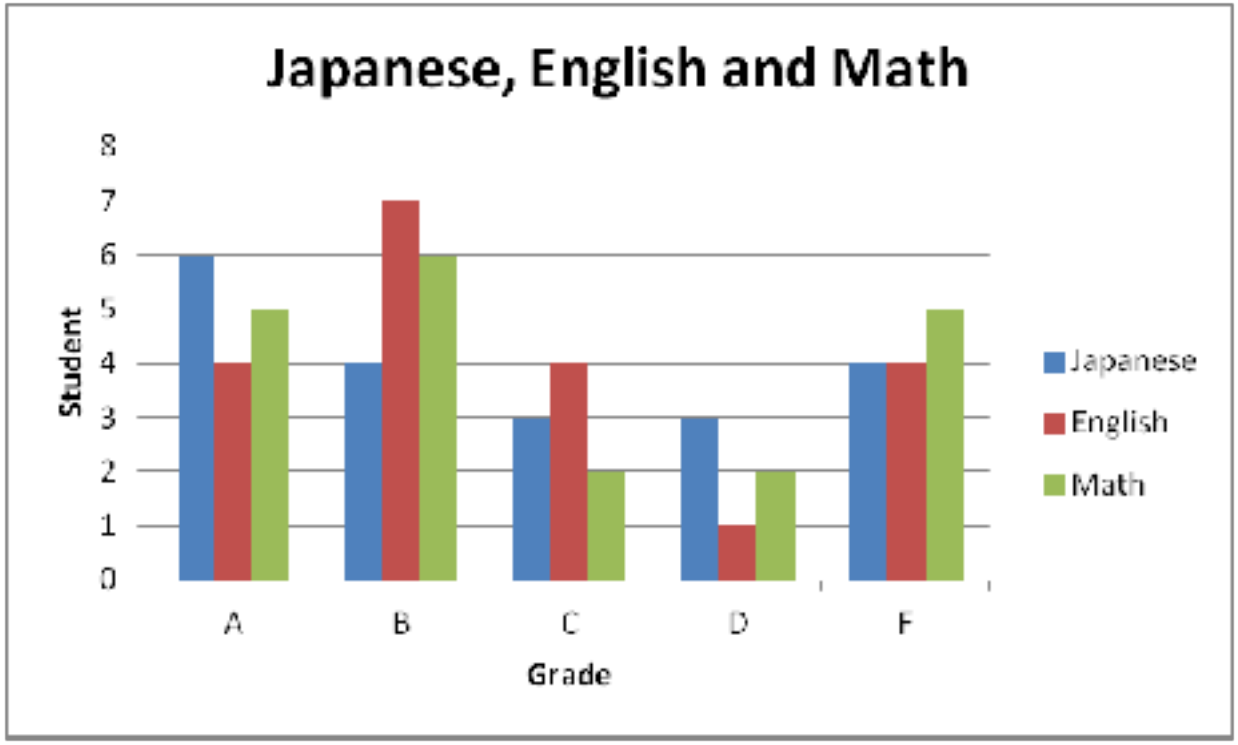
Other Charts

- Pie chart



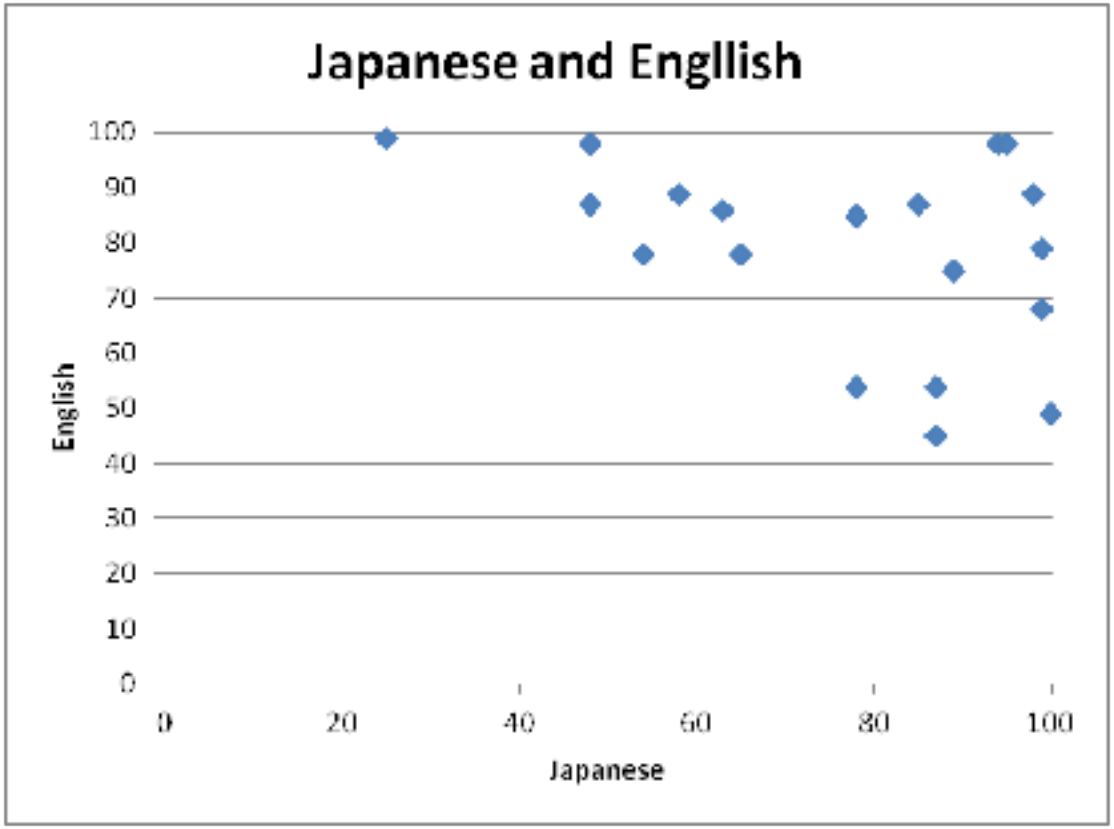
Even more

- Column chart



How many drawings can we have?

- XY (scatter)



情報基礎B (Computer Literacy)
Lecture 6: computer language

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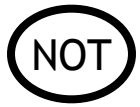
System Information Sciences
Design and Analysis of Information Systems

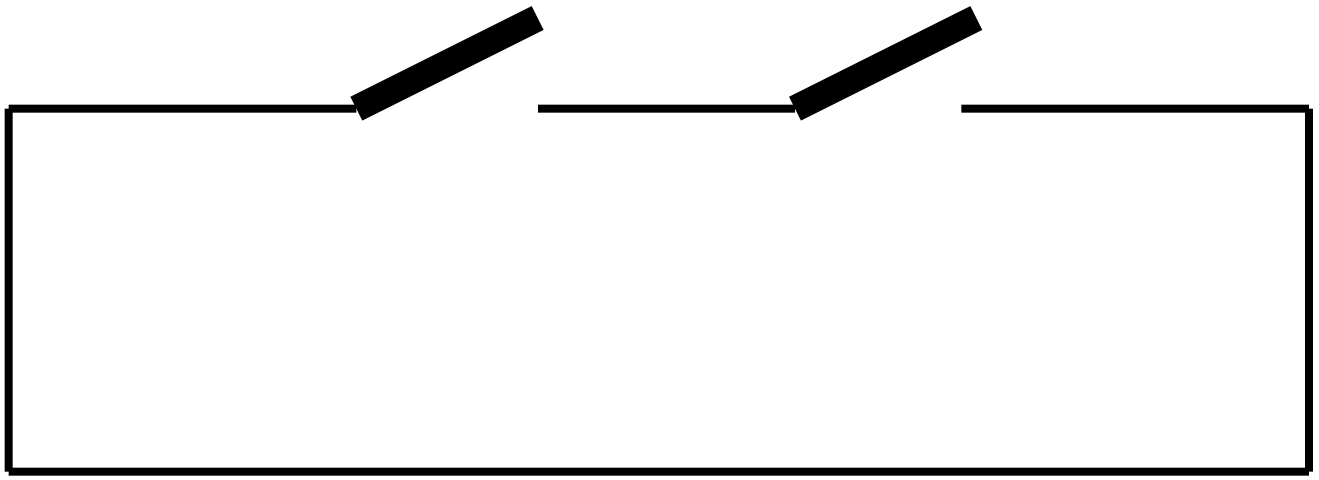
Computation

- The world of {0, 1}
  - Boolean algebra
  - Logical operation
- AND operation
  - $0 \times 0 = 0 \times 1 = 1 \times 0 = 0$, $1 \times 1 = 1$
  - Series circuit
- OR operation
  - $0 + 0 = 0$, $0 + 1 = 1 + 0 = 1$, $1 + 1 = 1$
  - Parallel circuit
- NOT operation
  - NOT(0) = 1, NOT(1) = 0



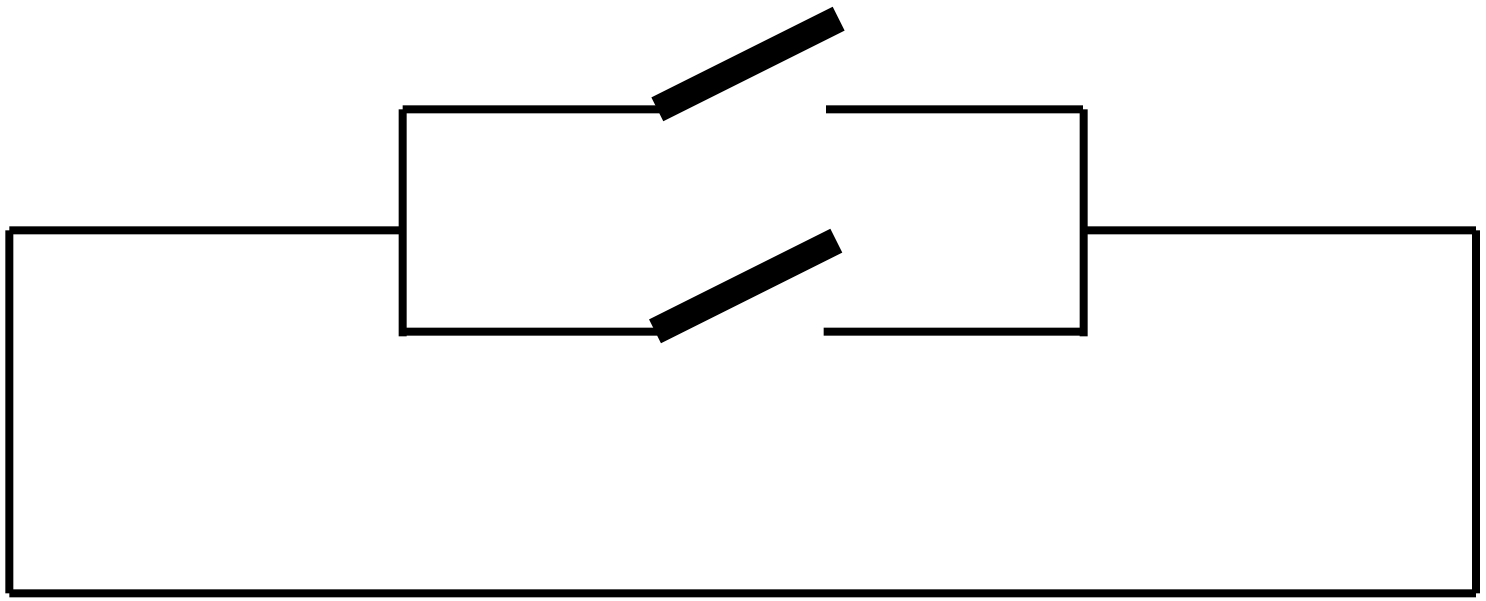
Computation

- AND operation
  - $0 \times 0 = 0 \times 1 = 1 \times 0 = 0,\ 1 \times 1 = 1$
  - Series circuit
  - Switching : relay, transistor, diode



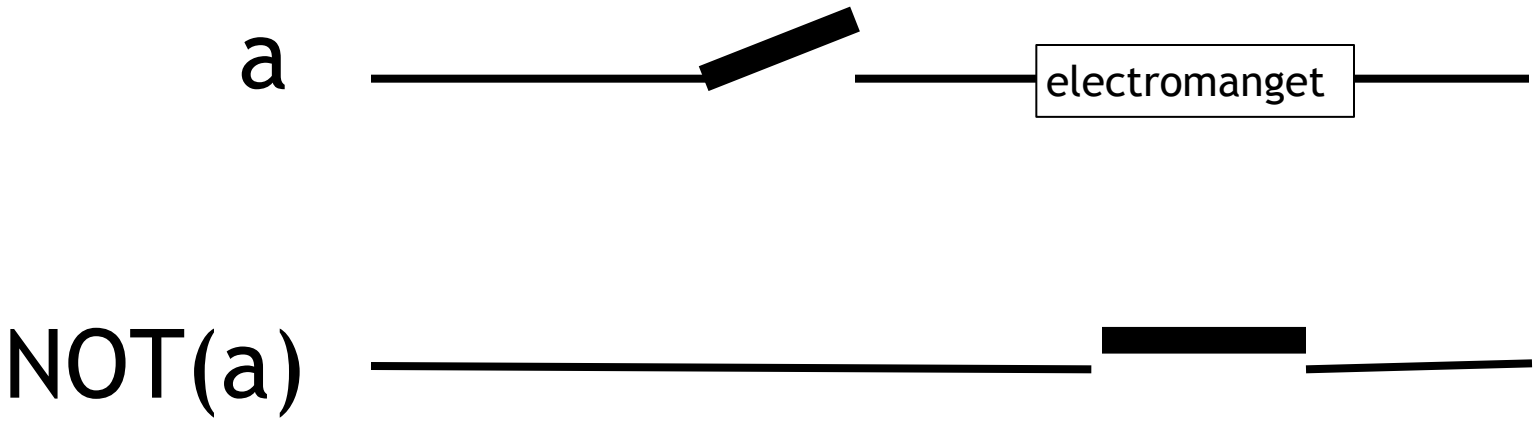
Computation

- OR operation
  - 0 + 0 = 0, 0 + 1 = 1 + 0 = 1, 1 + 1 = 1
  - Parallel circuit



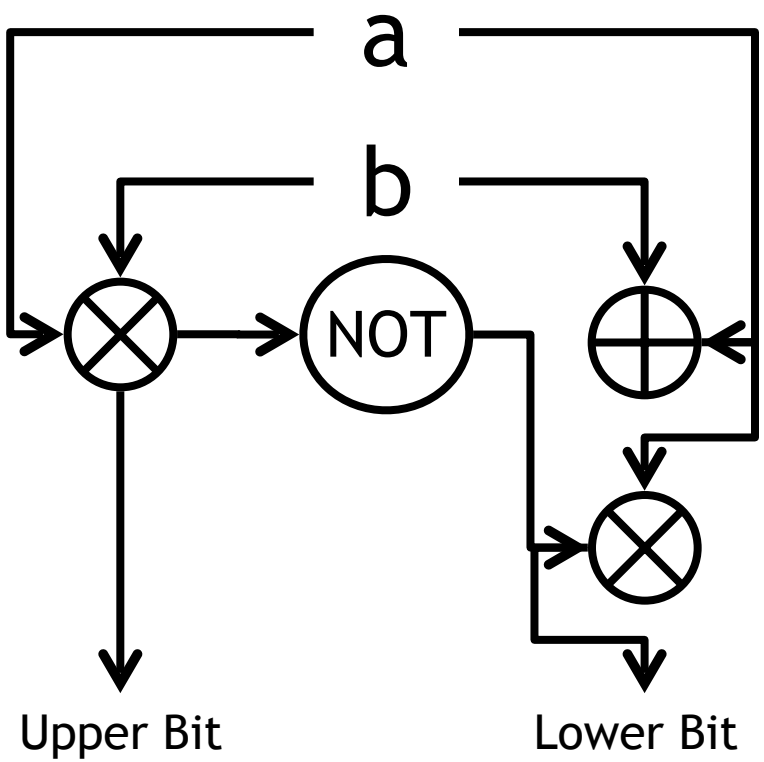
Computation

- NOT operation
  - NOT(0) = 1, NOT(1) = 0



Adding two bits

- Circuit to calculate a + b (a, b = 0 or 1)



0 + 0 = 00

1 + 0 = 01

0 + 1 = 01

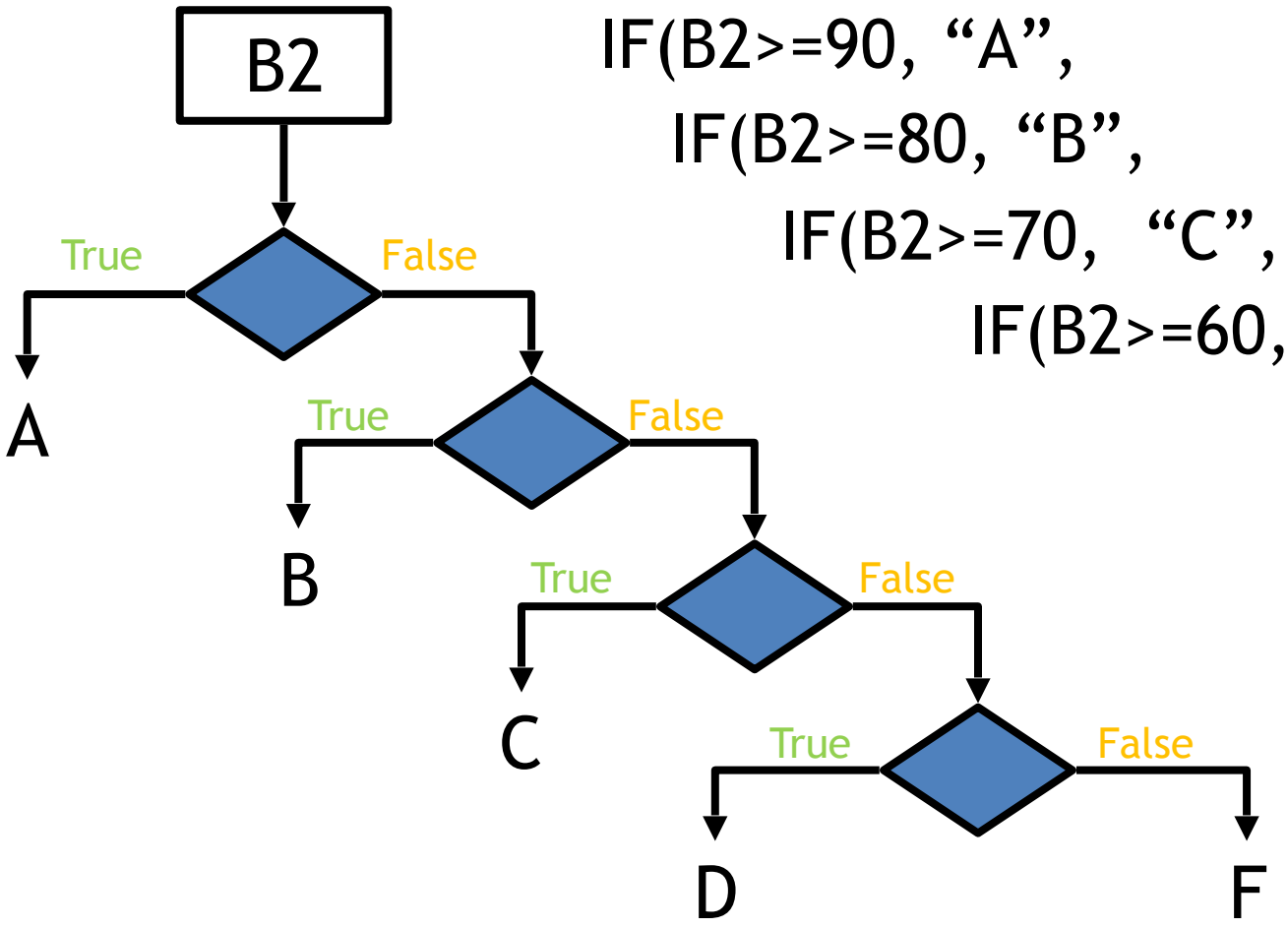
1 + 1 = 10

Computation Model

- AND, OR, NOT
  - Logic operations
  - Addition, subtraction, …
  - IF (via comparison)

- Programming model (decision tree model)
  - Basic math operations
  - Load data from storage
  - Move data to storage
  - IF operations to branch

Program and Decision Tree

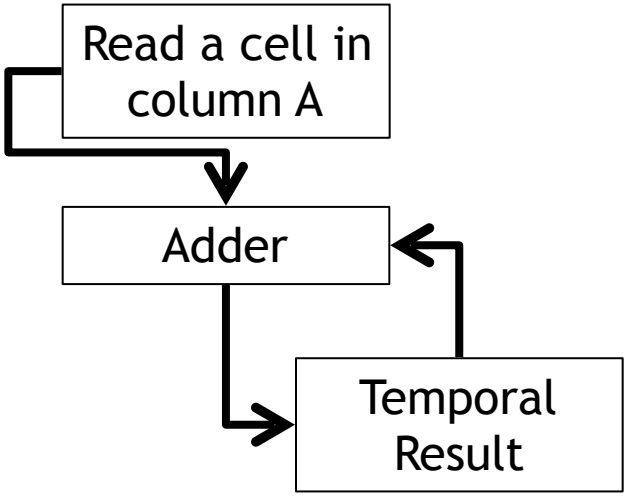



```
IF(B2>=90, “A”,
   IF(B2>=80, “B”,
      IF(B2>=70,  “C”,
         IF(B2>=60, “D”, “F”))))
```

Computation proceeds through the tree

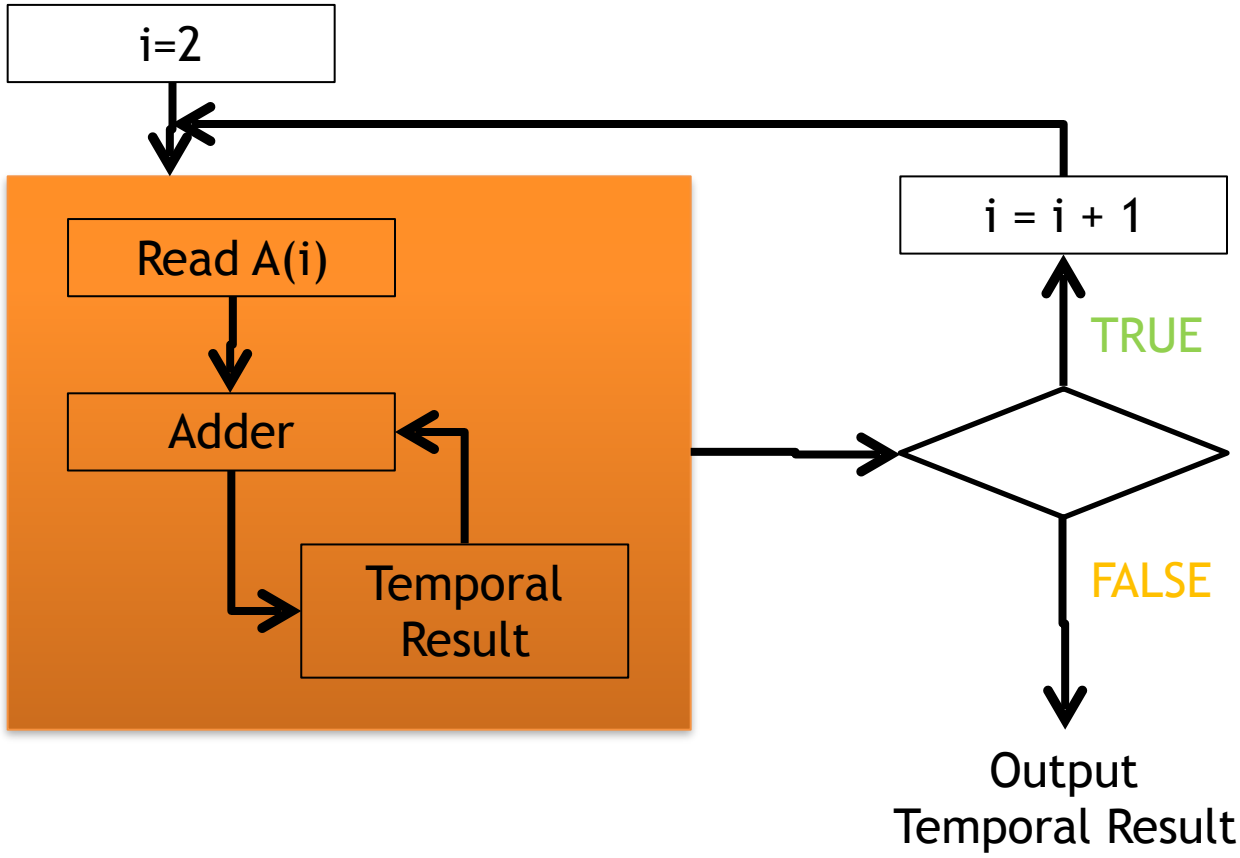
New tool: loop

- SUM(A2:A100)
  - Decision tree becomes deep
  - Loop structure
  - Loop management
    - When to stop?
    - In Excel…
      - By setting range A2:A100



Loop

- Example: SUM(A2:A100)



Programing

1. Think about an algorithm
   - e.g. Grading procedure
2. Show a flowchart with decision tree and loop structure
3. Write the algorithm in programming language
   - Simple easy vocabulary
   - No ambiguities

Programing

- Make operations for computers
  - Algorithm design
    - Logical thinking needed
  - Coding
    - Transform idea into “computer language”
  - Learning a programming language
    - Read programs
    - Change/make your own
    - Debug (error correction) is crucial

Programing hints

- Learning programming language
  - Practice makes perfect
- Follow examples
  - This is a pen > This is a dog
  - Follow good examples
- Learn from the mistakes
  - This is a apple ??
  - I is a man ??
  - 99.9999% of computer errors are our fault
- System guides in the type of error
  - Syntax error (i.e., #VALUE)
- Guess what is wrong/mistakes
  - Logical thinking helps

情報基礎B (Computer Literacy)
Lecture 7: If condition with VBA

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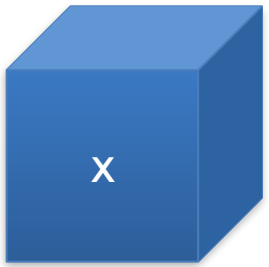
Variables

- A box used to store information
- Must declare the type first
  - e.g. prepare a box “x” to store an integer
  - Dim x As Integer
    - Declare variable “x” to store integers



  - Dim name As String
    - Stores text instead

Numeric Data types

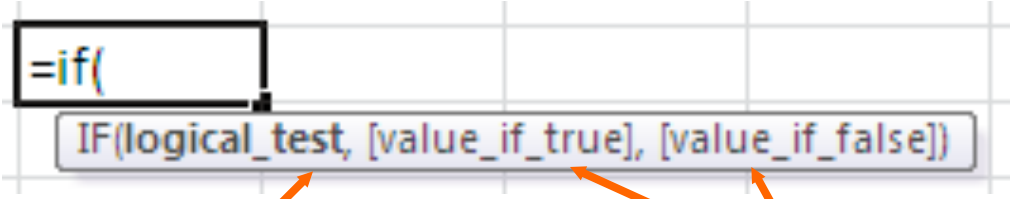
Data type name	Data	Value range	Size
Byte	Small integer	0 to 255	1 byte
Integer	Integer	-32,768 to 32,767	2 byte
Long	Long integer	-2,147,483,648 to 2,147,483,647	4 byte
Single	Short “real” number	$\pm 3.4 \times 10^{38}$ to $\pm 1.4 \times 10^{-45}$	4 byte
Double	Long “real” number	$\pm 1.8 \times 10^{308}$ to $\pm 4.9 \times 10^{-324}$	8 byte

Other Data Types

Data type	Value
Boolean	True, False
String	Text
Date	100/Jan/1 to 9999/Dec/31
Currency	Larger than Long, 922,337,203,477.5808 to 922,337,203,685,477.5807
Other	????

“IF” in Excel Function

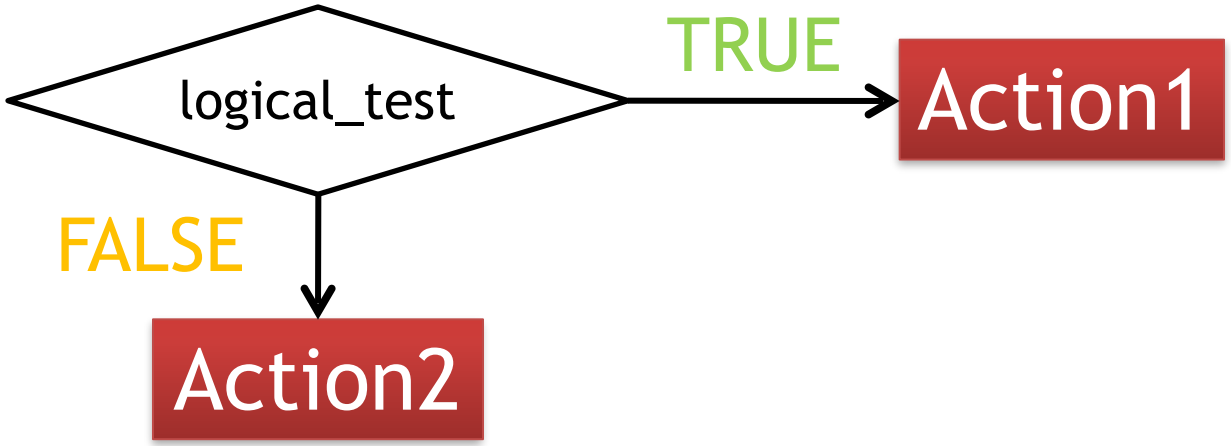
- Branch with “TRUE” or “FALSE”
- IF(logical_test, value_if_true, value_if_false)



Logical formula or Cell number

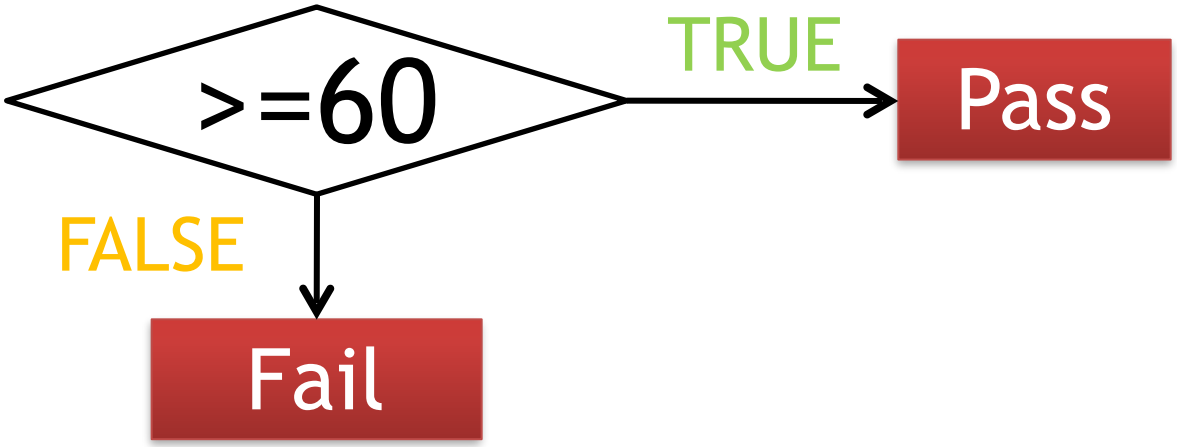
String with “” or just numbers

I f - Then - Else in VBA




```
If   logical_test   Then
        Action1
Else
        Action2
End  If
```

Grading in Excel

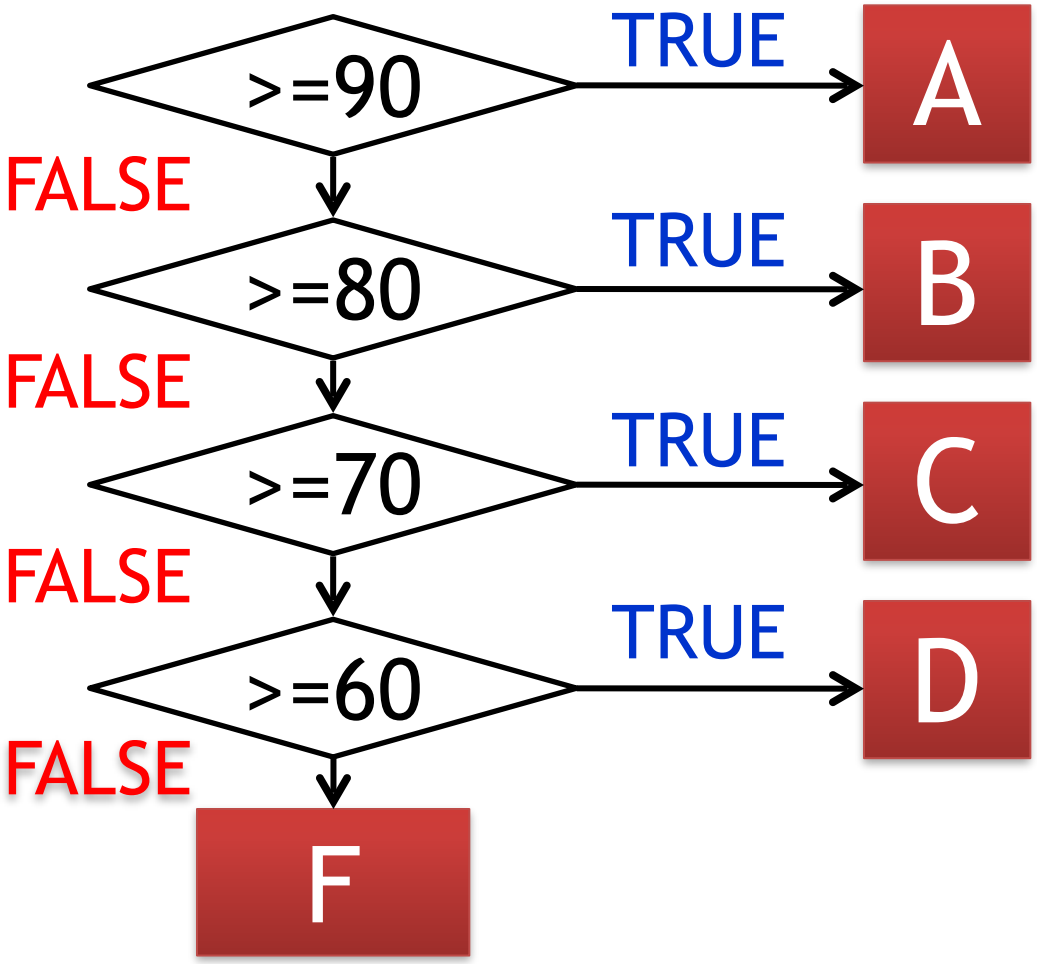


- Grading program in previous lecture
  - Pass if score is more than 60, fail otherwise
- D16 = IF(A1>=60, “Pass”, “Fail”)

Grading in VBA

```
1  Sub seiseki1()
2  ‘Grading Program
3
4    Dim score1 As Integer
5    Dim name1 As String
6
7    name1 = InputBox(“Enter your name.”)
8    score1 = InputBox(“Enter your score.”)
9
10   If score1 => 60 Then
11     MsgBox “Congratulations!” & name1 & ”, You passed the exam.”
12   Else
13     MsgBox name1 & ”, You failed the exam.”
14   End If
15
16 End Sub
```

Nesting “IF” conditions

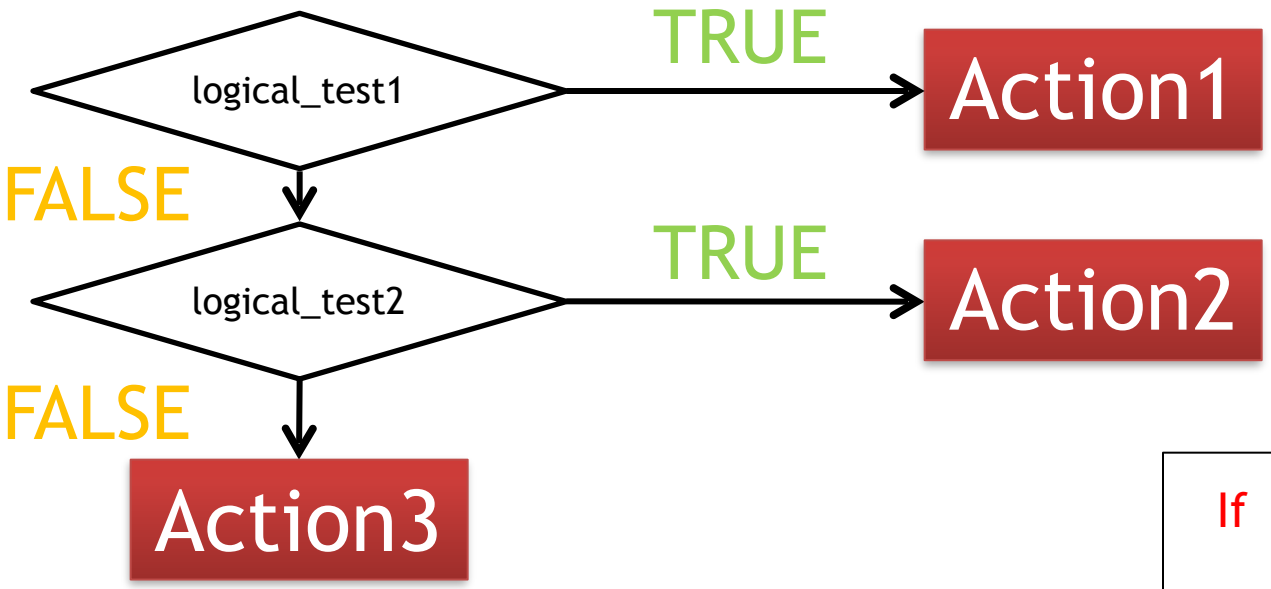


Nesting “IF”s in Excel

- Grade
  - A 100 > Score >= 90
  - B 90 > Score >= 80
  - C 80 > Score >= 70
  - D 70 > Score >= 60
  - F 60 > Score

```
=IF(B2>=90, ”A”,
  IF(B2>=80, ”B”,
  IF(B2>=70, ”C”,
  IF(B2>=60, ”D”, “F”))))
```

Nesting “If”s in VBA




```
If   logical_test1   Then
        Action1
ElseIf  logical_test2   Then
        Action2
Else
        Action3
End  If
```

Exercise 1

- Transform this excel formula into a VBA program

```
=IF(B2>=90, ”A”,
  IF(B2>=80, ”B”,
  IF(B2>=70, ”C”,
  IF(B2>=60, ”D”, “F”))))
```

Grading Program If-Then-Else

```
1   Sub seiseki2()
2   ‘Grading Program If-Then-Else
3
4     Dim score As Integer
5     Dim name As String
6
7     name = InputBox(“Enter your name.”)
8     score = InputBox(“Enter your score.”)
9
10    If   score >=90   Then
11      MsgBox name & ”, Your grade is A.”
12    ElseIf   score >=80  Then
13      MsgBox name & ”, Your grade is B.”
14    ElseIf   score >=70  Then
15      MsgBox name & ”, Your grade is C.”
16    ElseIf   score >=60   Then
17      MsgBox name & ”, Your grade is D.”
18    Else
19      MsgBox name & ”, Your grade is F.”
20    End If
21
22  End Sub
```

情報基礎B (Computer Literacy)
Lecture 8: Arrays and Loops

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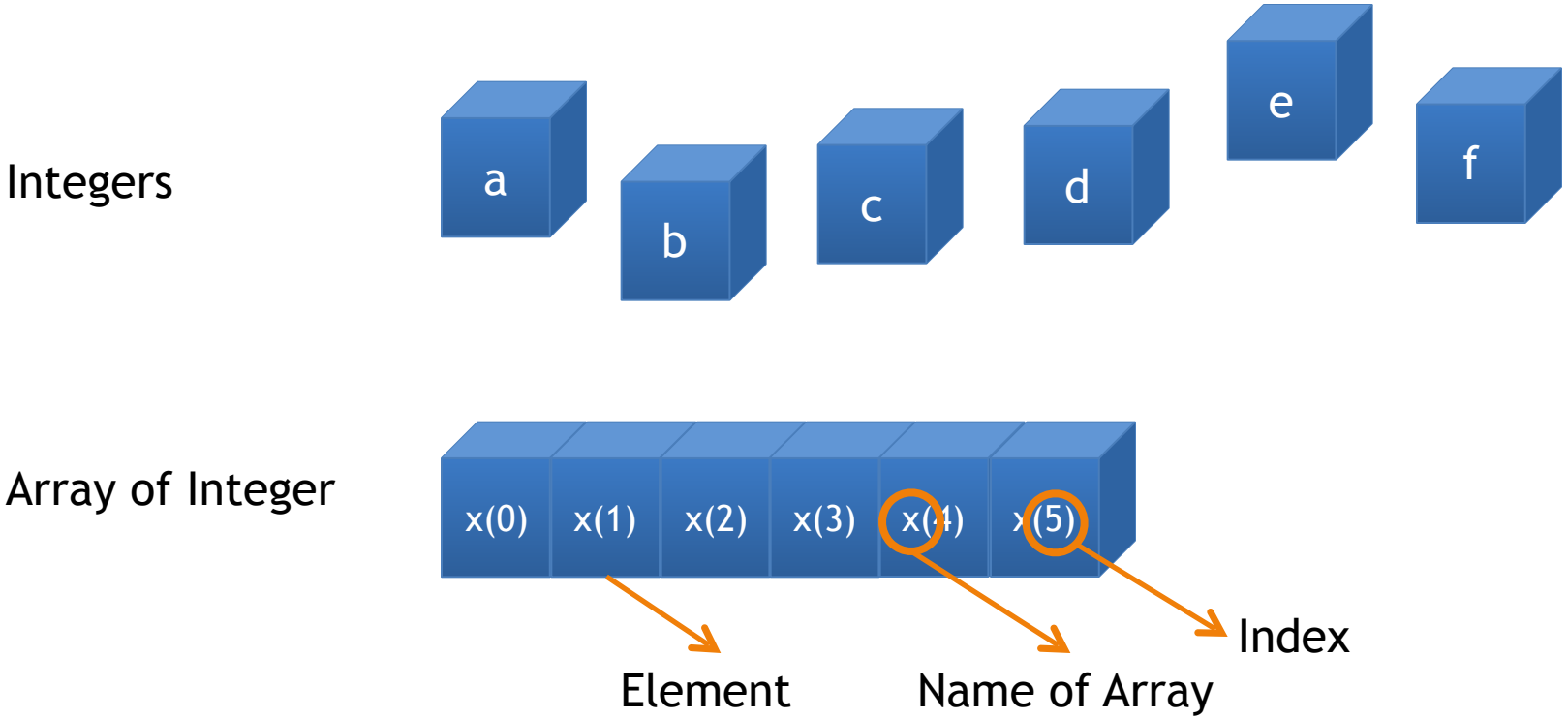
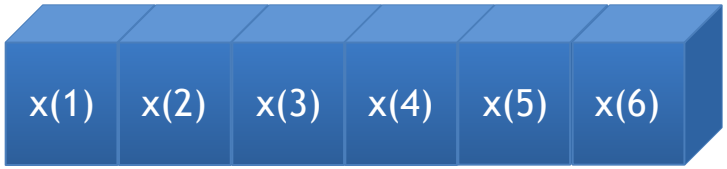
System Information Sciences
Design and Analysis of Information Systems

Array

- Collection of the same data type
  - Useful for lots of data of same type
  - i.e., grades per student

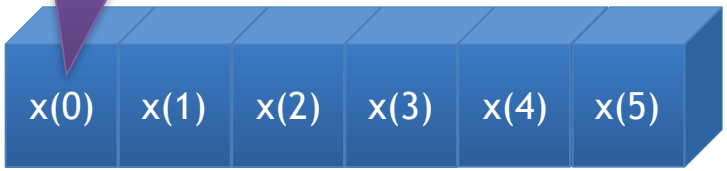


Declaring Arrays



Index starts at "0"

Six boxes to store Integer type variables
Box name: x, Index: 0 to 5




```
Dim x(5) As Integer
```

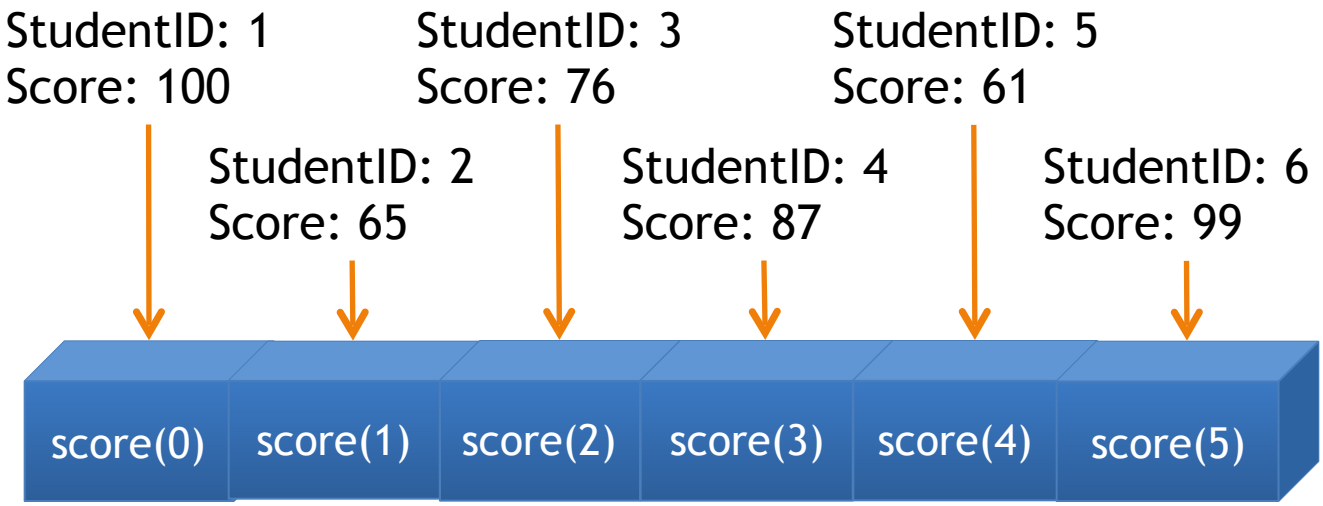
Array name

Maximum index

Data type

x(5): create six boxes named x each of which contains an Integer

Declaring Arrays

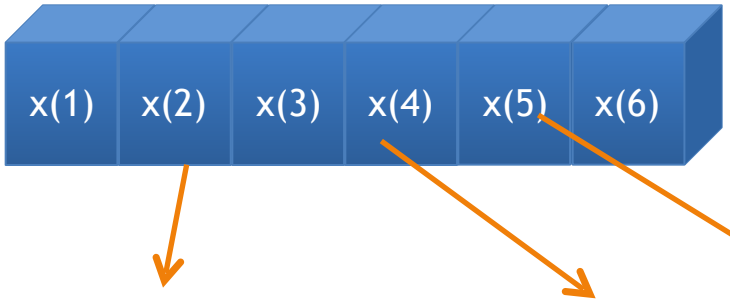


score(0) = 100
score(1) = 65
score(2) = 76

score(3) = 87
score(4) = 61
score(5) = 99

What if I don't have Id 0?

Array Declaration with Index



Element
Box x(1), x(2), … , x(6)

Array name

Index

```
Dim x(1 to 6) As Integer
```

Array name

Index Range

Data type

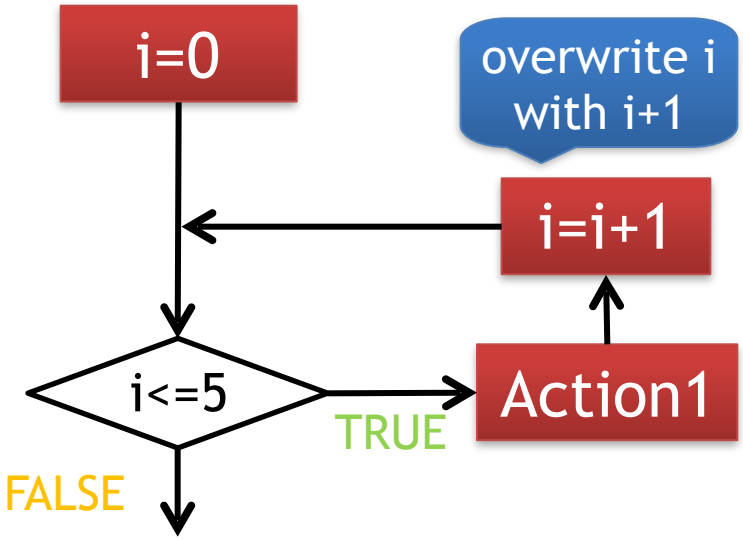
Using arrays in VBA

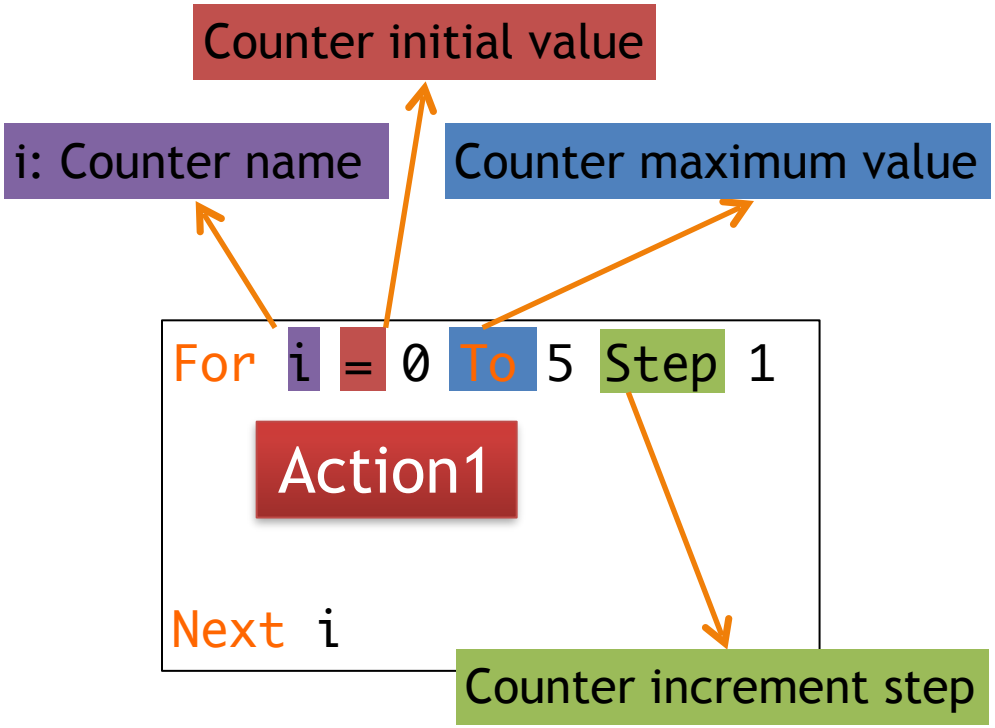
Student ID	Score
1	100
2	65
3	76
4	87
5	61
6	99

```
1   Sub array1()
2     Dim score(5) As Integer
3     score(0) = 100
4     score(1) = 65
5     score(2) = 76
6     score(3) = 87
7     score(4) = 61
8     score(5) = 99
9
10    MsgBox score(0)
11    MsgBox score(1)
12    MsgBox score(2)
13    MsgBox score(3)
14    MsgBox score(4)
15    MsgBox score(5)
16  End Sub
```

Looping

- Repeat same operation several times
  - i.e., compute average grade of each student
  - Use a counter to know when to stop
    - Counter variable: i

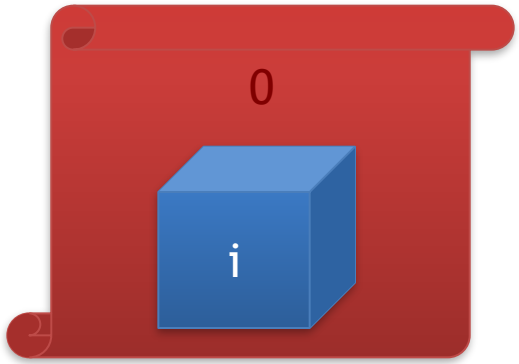




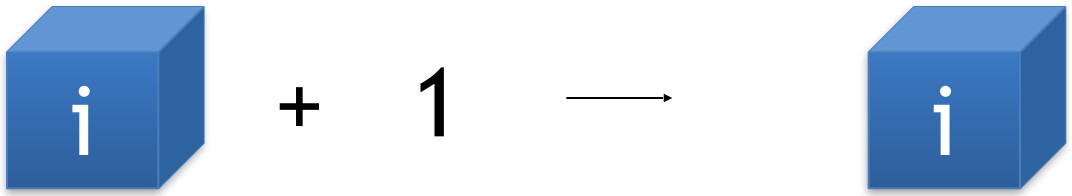
What is I?

```
Dim i As Integer
```

Counter name(arbitrary name): i



- What does i = i + 1 mean?
  - Store i + 1 onto i
  - i.e., increment i by 1



```
1   Sub array3()
2   Display StudentID and score of all students using a loop
3   ‘score: array name, i: counter name
4     Dim score(5) As Integer
5     Dim i As Integer
6
7     score(0) = 100
8     score(1) = 65
9     score(2) = 76
10    score(3) = 87
11    score(4) = 61
12    score(5) = 99
13
14    For i = 0 To 5 Step 1
15      MsgBox “StudentID: ” & i & “,  Score: ” & score(i)
16    Next i
17  End Sub
```

Student ID	Score
1	100
2	65
3	76
4	87
5	61
6	99

```
14      name(0) = “Koji Tanaka”
15      name(1) = “Hiroshi Abe”
16      name(2) = “Akiko Ito”
17      name(3) = “Ichiro Suzuki”
18      name(4) = “Takako Kato”
19      name(5) = “Junpei Kimura”
20
21      For i = 0 To 5 Step 1
22        MsgBox “StudentID: ” & i & “, Name: ” & name(i) & “, Score: ” &
        score(i)
23      Next I
24    End Sub
```

Student ID	name	Score
1	Koji Tanaka	100
2	Hiroshi Abe	65
3	Akiko Ito	76
4	Ichiro Suzuki	87
5	Takako Kato	61
6	Junpei Kimura	99

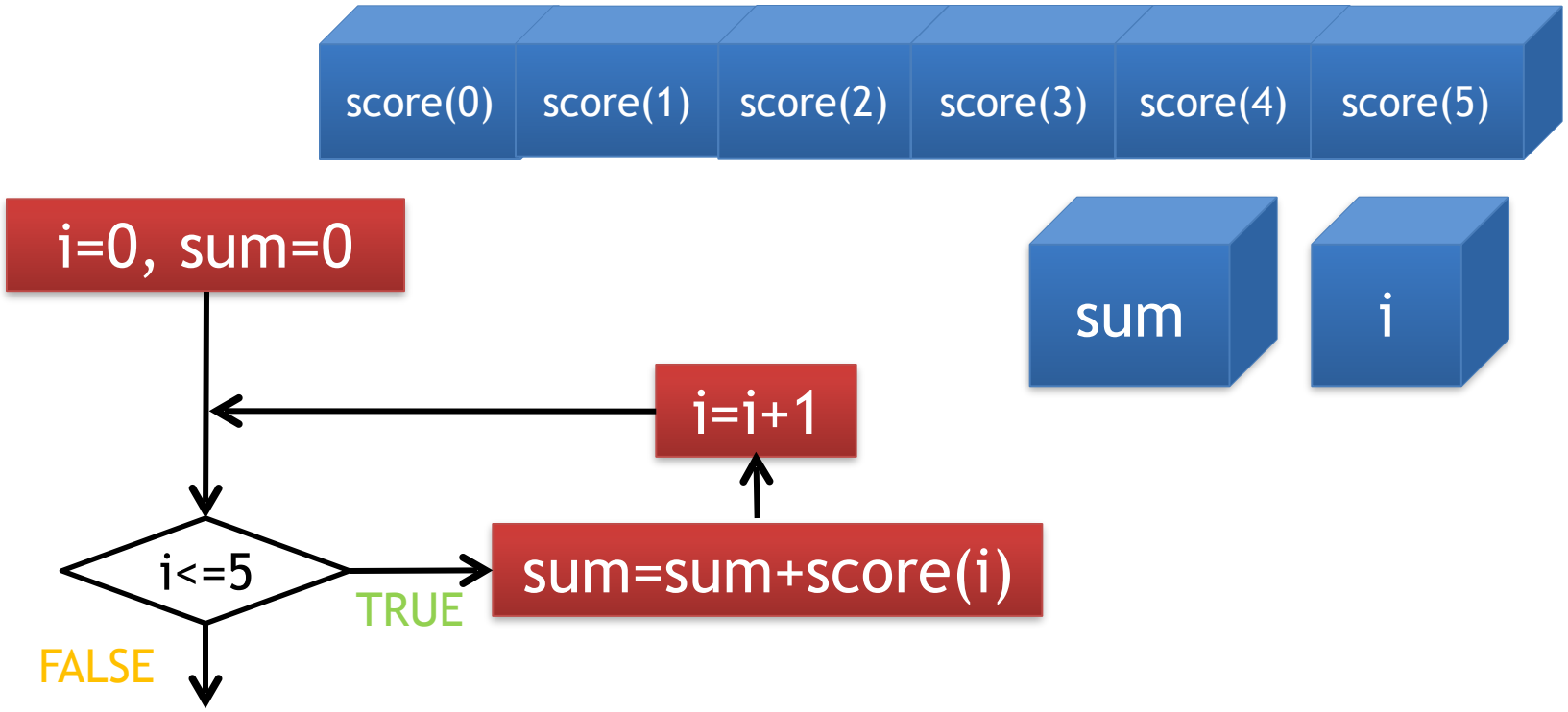
Exercise 2

- Make similar program that displays for each student if they “Pass” or “Fail” (instead of numerical score)
    - “Pass” only when score is equal or greater than 79
    - “Fail” otherwise
    - Display in increasing order of StudentID

– Ex. StudentID: 1, Name: Koji Tanaka, Score: 100, ->Pass

Sum of Scores

- Calculate the sum of score of a student



Exercise 3

- Compute the sum of scores of all students
- Report the sum and the average

```
1   Sub sum()
2   ‘Calculate the sum of score for all student using For - Next
3   ‘score: array name, i: counter
4   ‘sum: variable for sum, ave: variable for average
5     Dim score(5) As Integer
6     Dim i As Integer
7     Dim sum As Integer
8     Dim ave As Single
9     sum = 0
10    ave = 0.0
11    score(0) = 100
12    score(1) = 65
13    score(2) = 76
14    score(3) = 87
15    score(4) = 61
16    score(5) = 99
17    For i = 0 To 5 Step 1
18       sum = sum + score(i)
19    Next i
20    ave =   sum/6
21    MsgBox “Sum of score for ” & i+1 & “students is ” & sum
22    MsgBox “Average is ” & ave
23  End Sub
```

情報基礎B (Computer Literacy)
Lecture 9: more loops

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Let’s get started!

- Download the sample data
- Available in my webpage
  - http://www.dais.is.tohoku.ac.jp/~mati/
  - Google my name

Activating Macros in VBA

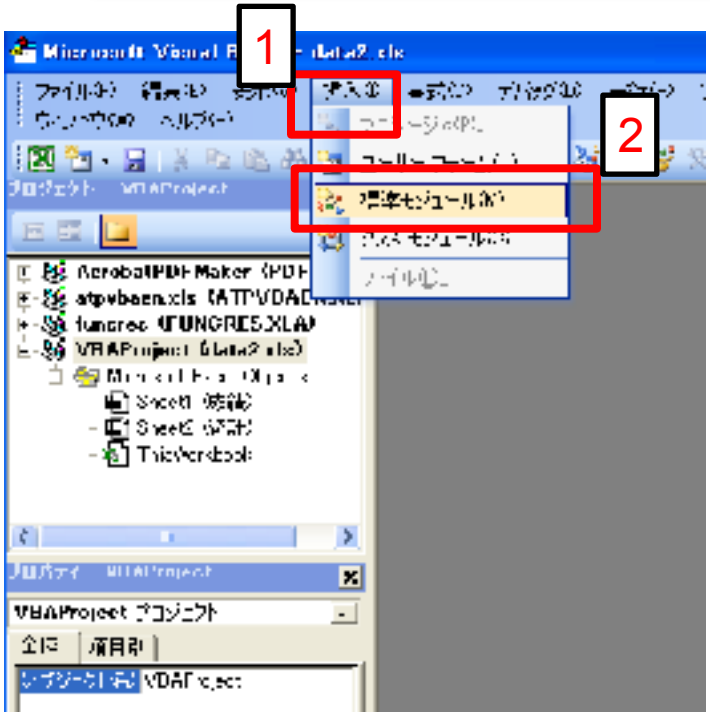
First we need to activate macros

BONUS: Why aren't they activated by default?

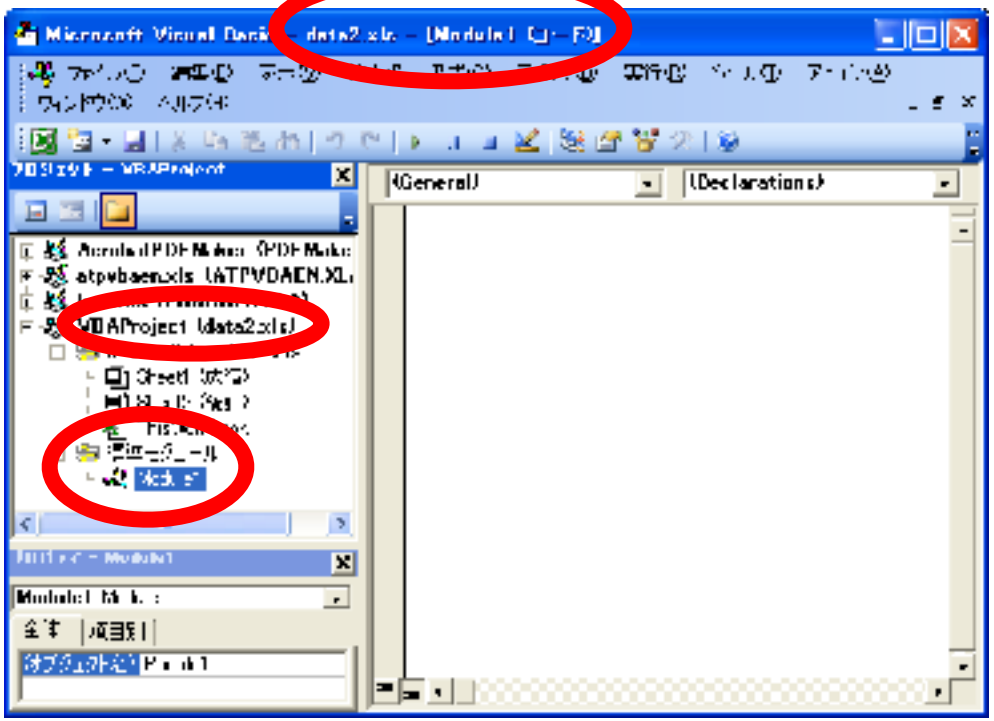
Backup your sheet!
Programming errors can delete your data.
You cannot undo operations!

Activating Macros

Insert -> Regular Module



Check if you are in data2.xls-[module1]



Accessing values

Cells(Row num, Col num)

```
If Cells(2,3)>60 Then
    Cells(4,7) = 30
End If
```

data2.xls

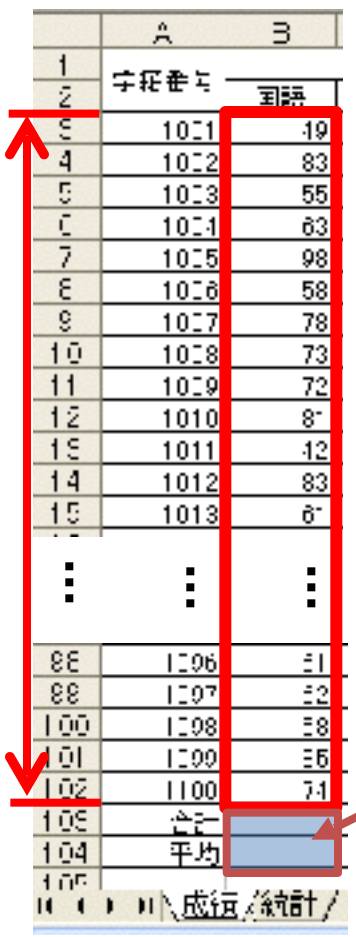
Sheet: Score

row: i

Sum and Average Example

Operation for Rows

A subject



Sum the grades of the 100 students in Japanese
Loop 100 cells;
100 cells: Row 3 to Row 102 on column B

Sum in B103
Average in B104
Use i for cell number

```
1   Sub sum_ave_japanese()
2     Dim  i  As Integer
3     Dim  sum As Integer
4
5     Worksheets("Score").Activate
6     sum = 0
7
8     For  i  = 3  To  102
9       sum = sum + Cells( i , 2 )
10    Next  I
11
12    'Write the Sum in B103
13    Cells( i ,  2 )  = sum
14    'Write the average in B104
15    Cells( i + 1, 2 ) = sum / 100
16
17  End Sub
```

Ex 1: Sum and Average for each Subject

Japanese

```
Sub sum_ave_japanese()
Dim  i As Integer
Dim  sum As Integer
Worksheets("Score").Activate
sum = 0
For  i  = 3  To  102
    sum = sum + Cells( i , 2 )
Next  i
Cells( i ,  2 )  = sum
Cells( i + 1 ,  2)  =  sum / 100
End Sub
```

English

Math

History

Chemistry

Science

Write a procedure to calculate sum and average for each subject using nested loop.

Ex 1: Sum and Average for each Subject

You can copy and edit for the other subject, but…

Japanese

```
Sub sum_ave_japanese()
Dim  i As Integer
Dim  sum As Integer
Worksheets("Score").Activate
sum = 0
For  i  = 3  To  102
    sum = sum + Cells( i , 2 )
Next  i
Cells( i ,  2 )  = sum
Cells( i + 1 ,  2)  =  sum / 100
End Sub
```

English

```
Sub sum_ave_english()
Dim  i As Integer
Dim  sum As Integer
Worksheets("Score").Activate
sum = 0
For  i  = 3  To  102
    sum = sum + Cells( i , 3 )
Next  i
Cells( i ,  3 )  = sum
Cells( i + 1 ,  3)  =  sum / 100
End Sub
```

Math

```
Sub sum_ave_math()
Dim  i As Integer
Dim  sum As Integer
Worksheets("Score").Activate
sum = 0
For  i  = 3  To  102
    sum = sum + Cells( i , 4 )
Next  i
Cells( i ,  4 )  = sum
Cells( i + 1 ,  4)  =  sum / 100
End Sub
```

History

```
Sub sum_ave_history()
Dim  i As Integer
Dim  sum As Integer
Worksheets("Score").Activate
sum = 0
For  i  = 3  To  102
    sum = sum + Cells( i , 5 )
Next  i
Cells( i ,  5 )  = sum
Cells( i + 1 ,  5)  =  sum / 100
End Sub
```

Chemistry

```
Sub sum_ave_chemistry()
Dim  i As Integer
Dim  sum As Integer
Worksheets("Score").Activate
sum = 0
For  i  = 3  To  102
    sum = sum + Cells( i , 6 )
Next  i
Cells( i ,  6 )  = sum
Cells( i + 1 ,  6)  =  sum / 100
End Sub
```

Science

```
Sub sum_ave_science()
Dim  i As Integer
Dim  sum As Integer
Worksheets("Score").Activate
sum = 0
For  i  = 3  To  102
    sum = sum + Cells( i , 7 )
Next  i
Cells( i ,  7 )  = sum
Cells( i + 1 ,  7)  =  sum / 100
End Sub
```

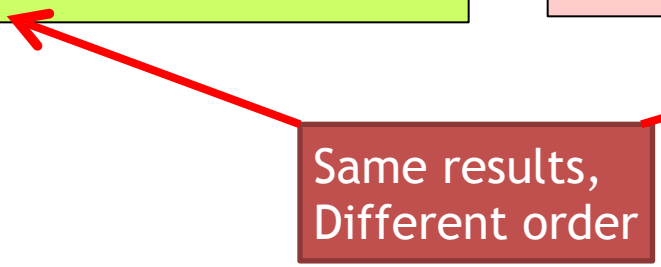
Write a procedure to calculate sum and average for each subject using nested loop.

Nesting For operations

Procedure to output “rownum *colnum” on each cell in A1 to J10

```
For  j = 1  to  10
    For  i = 1 to 10
        cells(i, j) = i * j
    Next  i
Next  j
```

```
For  i = 1  to  10
    For  j = 1 to 10
        cells(i, j) = i * j
    Next  j
Next  i
```



Using that for many grades

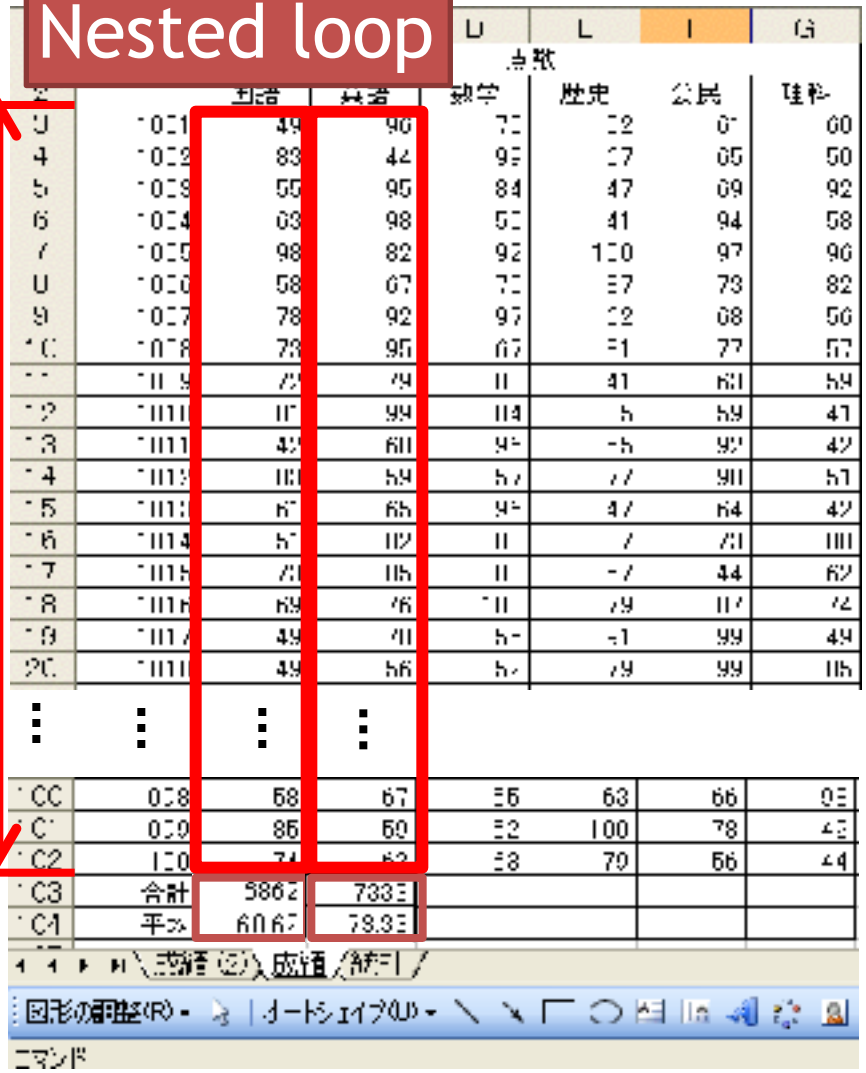
data2.xls

Sheet: Score

Row: i

Column: j

Nested loop



Calculate sum and average
for each subject.
Nest structure is below

For j ■ to ■ — column(subject)

  For i ■ to ■

  Next i — row(student)

Next j

Using that for many grades

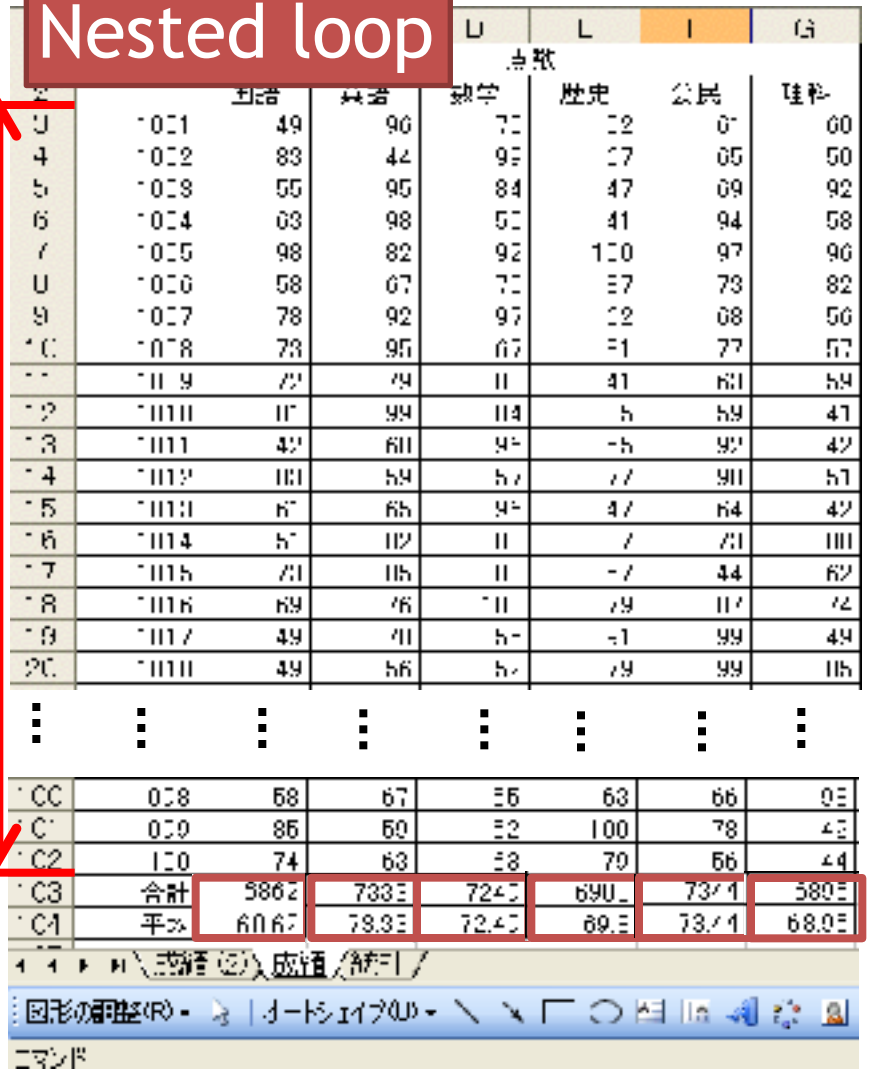
data2.xls

Sheet: Score

Row: i

Column: j

Nested loop

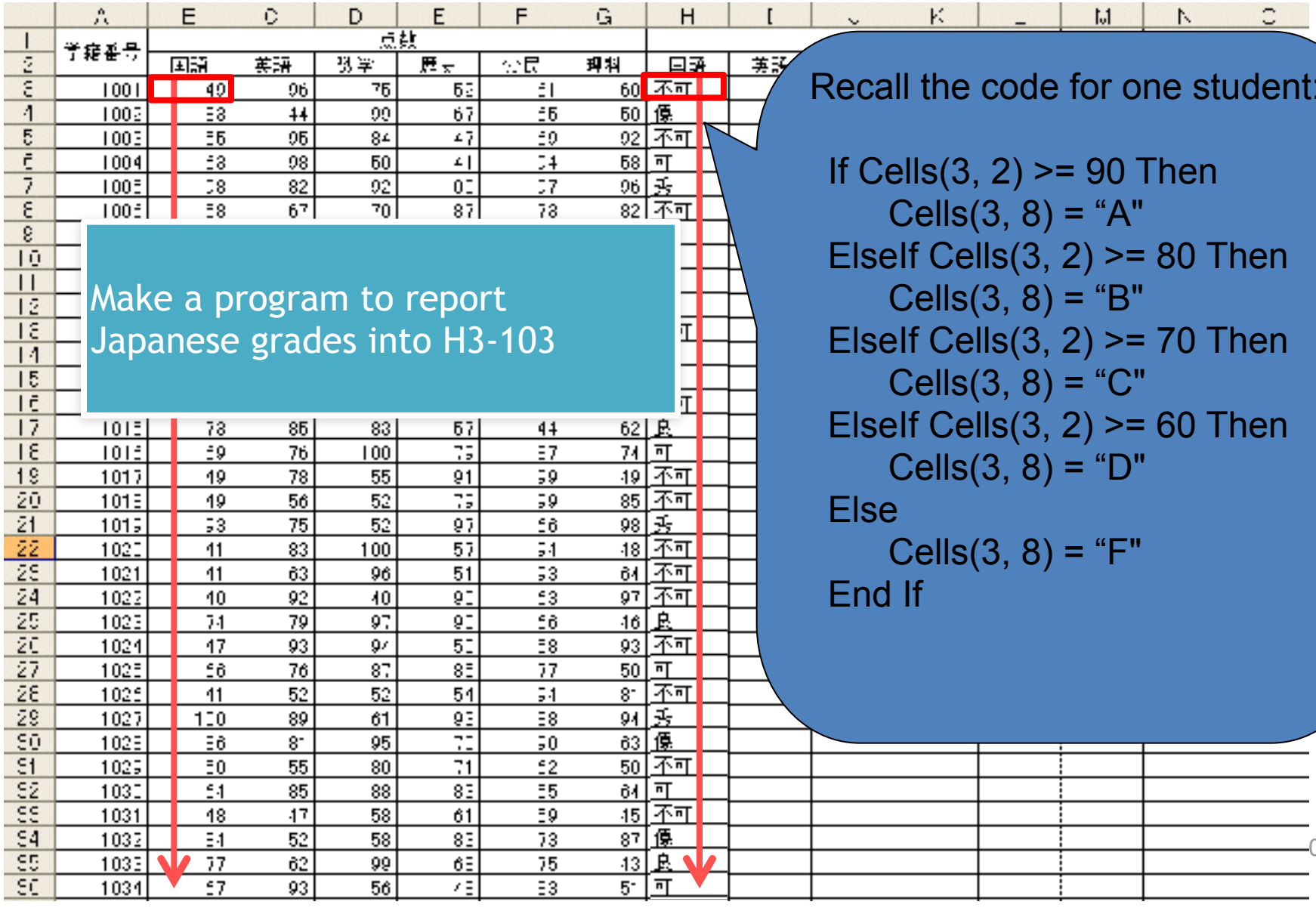


```
1   Sub sum_ave_6sub()
2     Dim  i  As Integer
3     Dim  j As Integer
4     Dim sum2 As Integer
5     Worksheets("Score").Activate
6
7     For  j  = 2  To  7
8       sum2 = 0
9       For i= 3 to 102
10        sum2 = sum2 + Cells(i, j)
11      Next i
12      'Sum B103
13      Cells( i ,  2 )  = sum1
14      'Average B104
15      Cells(i+1 , 2)  =  sum1 / 100
16    Next j
17  End Sub
```

Be careful when initialize "sum2"

Grading for each subject

Grading for Japanese



Make a program to report Japanese grades into H3-103

Recall the code for one student:

```
If Cells(3, 2) >= 90 Then
    Cells(3, 8) = “A"
ElseIf Cells(3, 2) >= 80 Then
    Cells(3, 8) = “B"
ElseIf Cells(3, 2) >= 70 Then
    Cells(3, 8) = “C"
ElseIf Cells(3, 2) >= 60 Then
    Cells(3, 8) = “D"
Else
    Cells(3, 8) = “F"
End If
```

Grading Japanese

data2.xls

Sheet: Score

Row: i

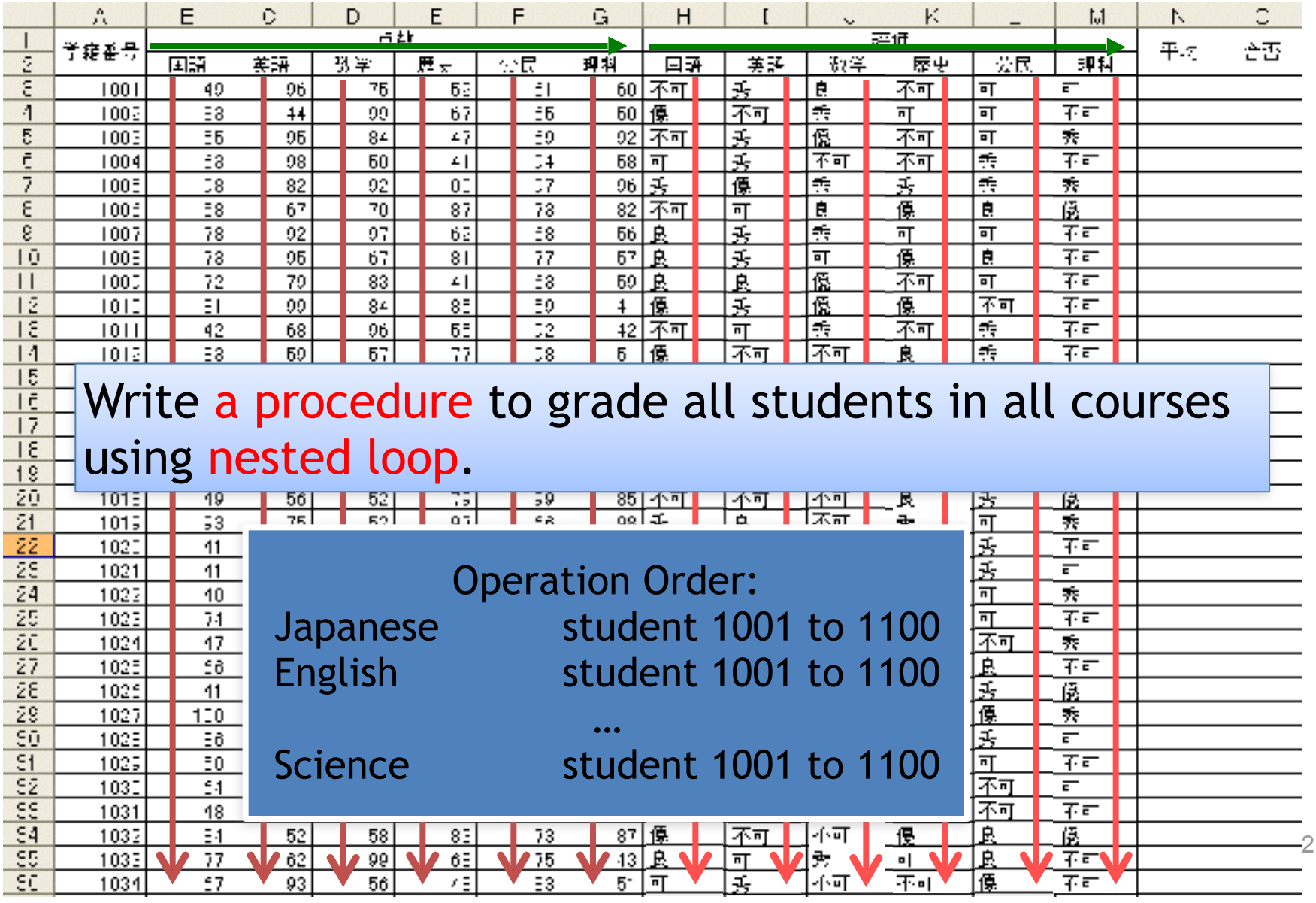
・Grading criterion

A: if score >= 90
B: if 90 > score >= 80
C: if 80 > score >= 70
D: if 70 > score >= 60
F: if 60 > score

```
1   Sub grade_jp()
2     Dim  i  As Integer
3     Worksheets("Score").Activate
4
5     For i = 3 To 102
6       If Cells(i, 2) >= 90 Then
7         Cells(i, 8) = "A"
8       ElseIf Cells(i, 2) >= 80 Then
9         Cells(i, 8) = "B"
10      ElseIf Cells(i, 2) >= 70 Then
11        Cells(i, 8) = "C"
12      ElseIf Cells(i, 2) >= 60 Then
13        Cells(i, 8) = "D"
14      Else
15        Cells(i, 8) = "F"
16      End If
17    Next i
18  End Sub
```

Grading each subject

Nested loop



Write a procedure to grade all students in all courses using nested loop.

Operation Order:

Japanese student 1001 to 1100
English student 1001 to 1100
…
Science student 1001 to 1100

Grading each Subject

data2.xls

Sheet: Score

Nested loop

・Grading criterion

A: if score >= 90
B: if 90 > score >= 80
C: if 80 > score >= 70
D: if 70 > score >= 60
F: if 60 > score

```
1   Sub grade_6sub()
2     Dim i As Integer
3     Dim j As Integer
4     Worksheets("Score").Activate
5     For j = 2 To 7
6       For i = 3 To 102
7         If Cells(i, 2) >= 90 Then
8           Cells(i, 8) = "A"
9         ElseIf Cells(i, 2) >= 80 Then
10          Cells(i, 8) = "B"
11        ElseIf Cells(i, 2) >= 70 Then
12          Cells(i, 8) = "C"
13        ElseIf Cells(i, 2) >= 60 Then
14          Cells(i, 8) = "D"
15        Else
16          Cells(i, 8) = "F"
17        End If
18      Next i
19    Next j
20  End Sub
```

Row: i

Col: j

情報基礎B (Computer Literacy)
Lecture 10: VBA in Excel

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Two dimensional Arrays

Array x(9)

x(0)
x(1)
x(2)
x(3)
x(4)
x(5)
x(6)
x(7)
x(8)
x(9)

Array y(5)

y(0)
y(1)
y(2)
y(3)
y(4)
y(5)
y(6)
y(7)
y(8)
y(9)

Array z(5)

z(0)
z(1)
z(2)
z(3)
z(4)
z(5)
z(6)
z(7)
z(8)
z(9)

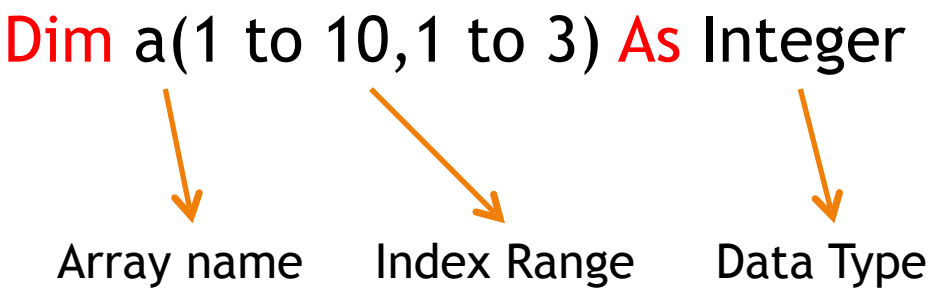
2-dimensional Array

a(0,0)	a(0,1)	a(0,2)
a(1,0)	a(1,1)	a(1,2)
a(2,0)	a(2,1)	a(2,2)
a(3,0)	a(3,1)	a(3,2)
a(4,0)	a(4,1)	a(4,2)
a(5,0)	a(5,1)	a(5,2)
a(6,0)	a(6,1)	a(6,2)
a(7,0)	a(7,1)	a(7,2)
a(8,0)	a(8,1)	a(8,2)
a(9,0)	a(9,1)	a(9,2)

Declaring Two dimensional arrays

- ArrayName(Row index range, Column index range)

a(0,0)	a(0,1)	a(0,2)
a(1,0)	a(1,1)	a(1,2)
a(2,0)	a(2,1)	a(2,2)
a(3,0)	a(3,1)	a(3,2)
a(4,0)	a(4,1)	a(4,2)
a(5,0)	a(5,1)	a(5,2)
a(6,0)	a(6,1)	a(6,2)
a(7,0)	a(7,1)	a(7,2)
a(8,0)	a(8,1)	a(8,2)
a(9,0)	a(9,1)	a(9,2)

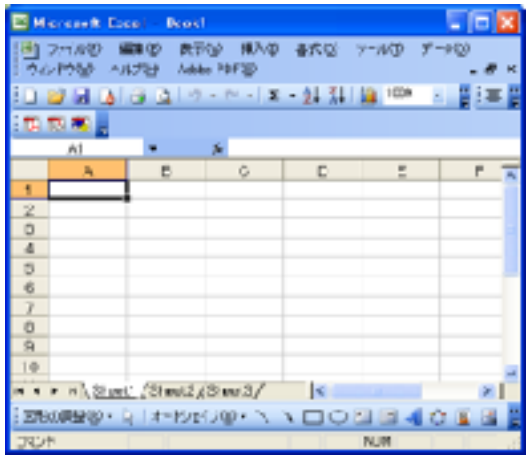


2-dimensional array (score per student and course)
Array name: a
Number of variables: 10*3=30

Equivalent in Excel

Cells(row, column)

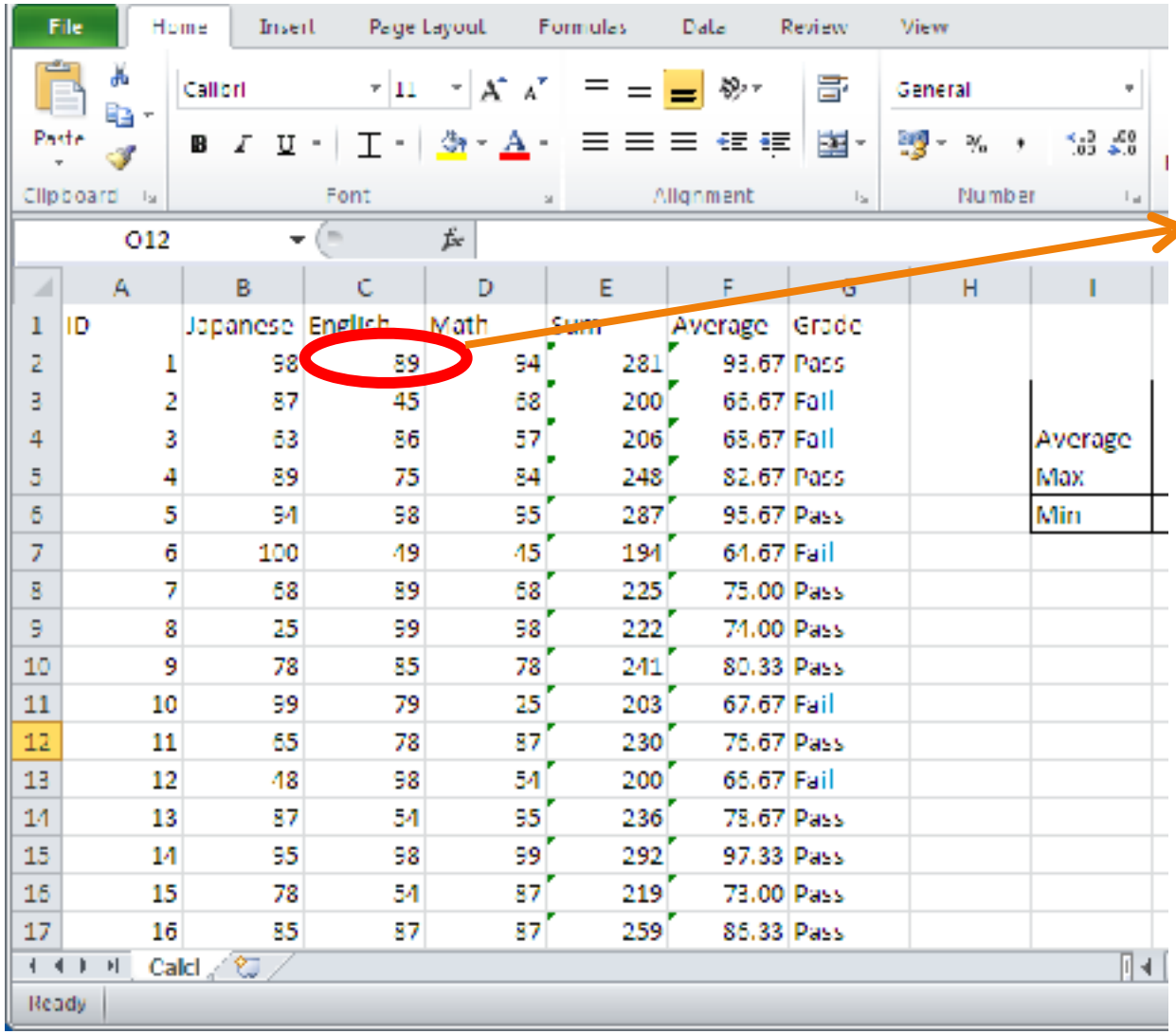
A1	B1	C1
A2	B2	C2
A3	B3	C3
A4	B4	C4
A5	B5	C5
A6	B6	C6
A7	B7	C7
A8	B8	C8
A9	B9	C9
A10	B10	C10



cells(0,0)	cells(0,1)	cells(0,2)
cells(1,0)	cells(1,1)	cells(1,2)
cells(2,0)	cells(2,1)	cells(2,2)
cells(3,0)	cells(3,1)	cells(3,2)
cells(4,0)	cells(4,1)	cells(4,2)
cells(5,0)	cells(5,1)	cells(5,2)
cells(6,0)	cells(6,1)	cells(6,2)
cells(7,0)	cells(7,1)	cells(7,2)
cells(8,0)	cells(8,1)	cells(8,2)
cells(9,0)	cells(9,1)	cells(9,2)

Row number starts from 1 in Excel!

Beware of Switch!



Cell Index: C2

Range("C2")
or
Cells(2,3)
in VBA

Range("Column Row")

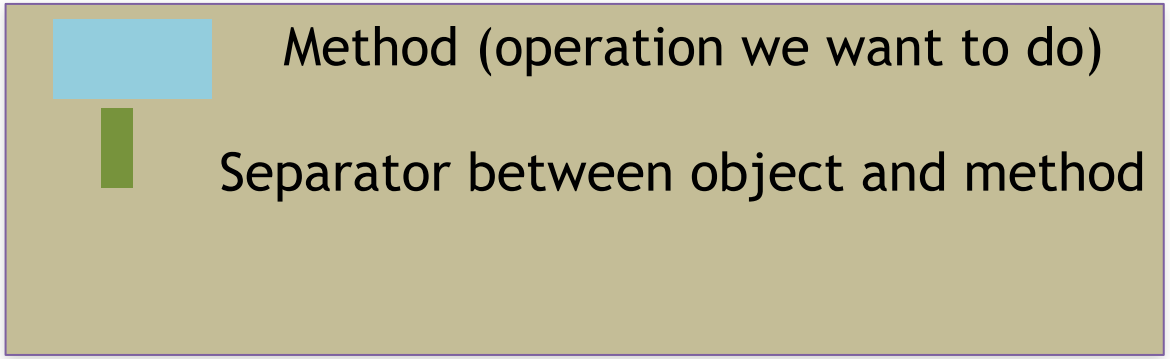
Cells(Column index, Row index)

Methods

- Operation for object
  - Delete, Open and more

```
1   ThisWorkbook.Worksheets("Sheet1”).Range("A:A”).Delete
```

Affects whole column!



Method examples

- Many ways of interacting with Excel
  - Color, Value, … anything!
  - Google for more!

```
1    ThisWorkbook . Worksheets("Sheet1") . Range("A:A") . Value = 1

1    ThisWorkbook . Worksheets("Sheet1") . Range("A:A") . Interior.ColorIndex = 4

1    ThisWorkbook . Worksheets("Sheet1") . Range("A:A") . Delete
```

Separating Procedures

- Code begins from “Sub” to end with “End Sub”

```
1  Sub exercise1()
2    ThisWorkbook.Worksheets("Sheet1").Range("A:A").Value = 1
3  End Sub
```

```
1  Sub exercise2()
2  ThisWorkbook.Worksheets("Sheet1").Range("A:A").Interior.ColorIndex=4
3  End Sub
```

```
1  Sub exercise3()
2    ThisWorkbook.Worksheets("Sheet1").Range("A:A").Delete
3  End Sub
```

Affecting multiple cells

- Range operation
- i.e., set the cell value of several cells
  – Different code, same result

```
1  Sub Example_Range1()
2    ActiveSheet.Range(“A1”).Value = 10
3  End Sub
```

```
1  Sub Example_Cells1()
2    ActiveSheet.Range(1, 1).Value = 10
3  End Sub
```

Simple programs

- Output the sum of A1 and A2 to A3 with Range

```
1  Sub Example_Range3()
2    Range("A3") = Range("A1") + Range("A2")
3  End Sub
```

- Output the sum of A1 and A2 to A4 with Cells

```
1  Sub Example_Cells3()
2    Cells(4,1) = Cells(1,1) + Cells(2,1)
3  End Sub
```

Sum of Cells B1 to B10

- Output the sum of B1 to B10 to B11 with Range

```
1   Sub Example_Range4()
2     Range("B11") = Range("B1")  + Range("B2")
            + Range("B3") + Range("B4") + Range("B5")
            + Range("B6") + Range("B7") + Range("B8")
            + Range("B9") + Range("B10")
3   End Sub
```

Can you program this in a better way?

Sum of Cells B1 to B10

- Output the sum of B1 to B10 to B11 with Cells

```
1   Sub Example_Cells5()
2     Dim i As Integer
3     Dim sum1 As Integer
4     sum1=0
5
6     For i = 1 to 100
7       sum1 = sum1 + Cells (i, 2)
8     Next i
9
10    Cells(i, 2) = sum1
11  End Sub
```

情報基礎A
Lecture 11: Batch processing

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Average Score for one Student

Column Operation

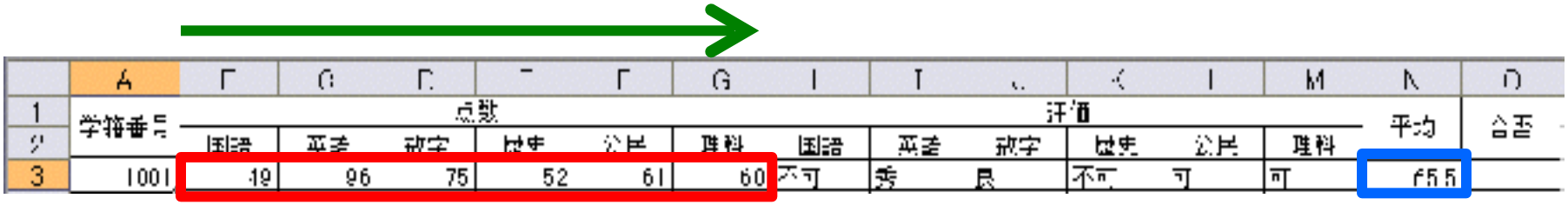
Make a procedure to compute the average score of student 1001 into N3

data2.xls

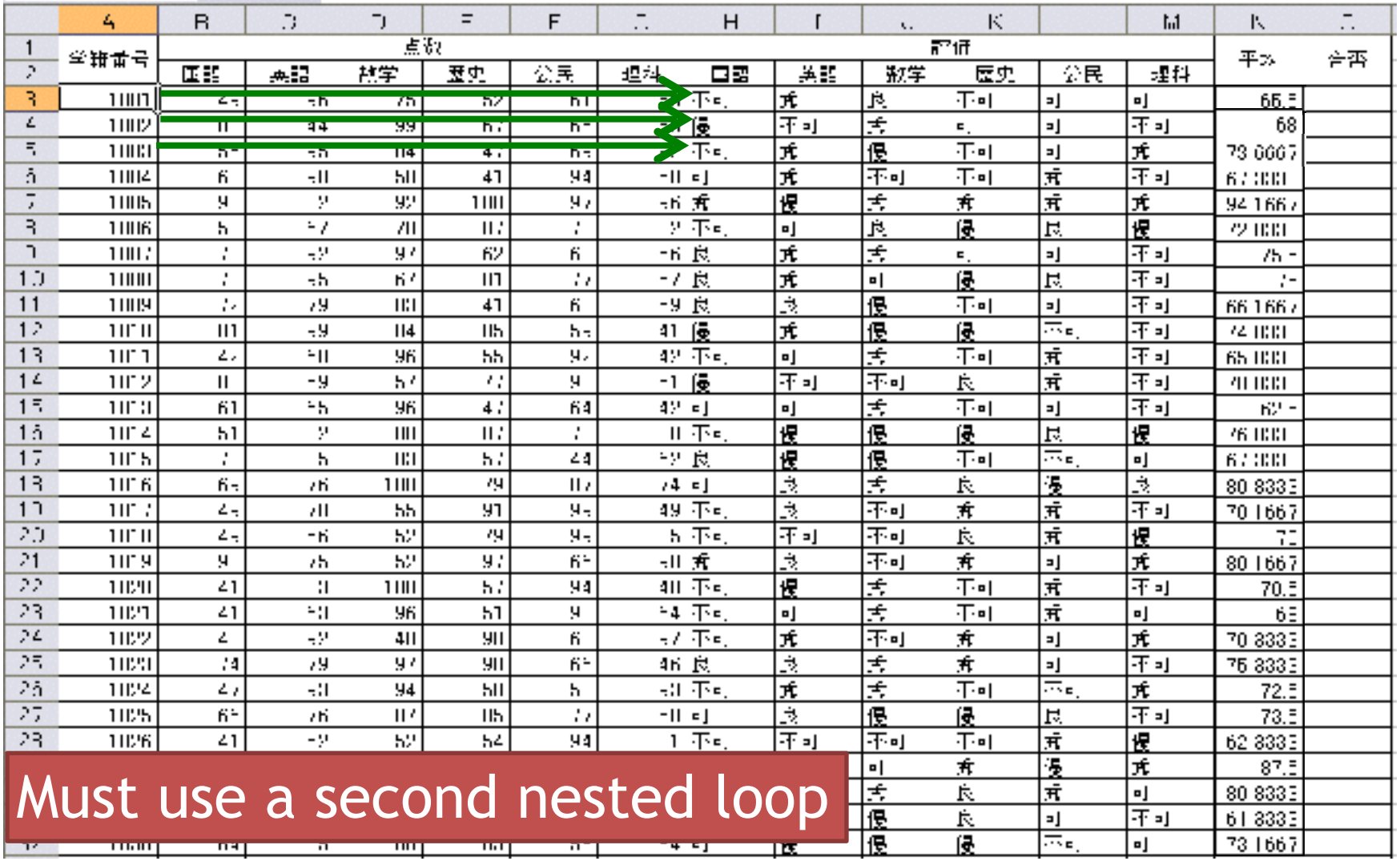
Sheet: Score

Column: j

```
1   Sub student_ave()
2     Dim j As Integer
3     Dim sum3 As Integer
4     Worksheets("Score").Activate
5
6     sum3 = 0
7
8     For j = 2 To 7
9       sum3 = sum3 + Cells( 3, j )
10    Next j
11
12    Cells( 3,  j + 6)  =  sum3 / 6
13
14  End Sub
```



Same operation for 100 Students



Must use a second nested loop

Average Score for 100 Students

Procedure that computes average score of each student

data2.xls

Sheet: Score

Column: j

Row: i

One loop is nested inside the other

```
1   Sub student_ave()
2     Dim i As Integer
3     Dim j As Integer
4     Dim sum4 As Integer
5     Worksheets("Score").Activate
6
7     For i = 3 To 102
8       sum4 = 0
9       For j = 2 To 7
10        sum3 = sum3 + Cells( i, j )
11      Next j
12      Cells( i,  j + 6) = sum4 / 6
13    Next i
14  End Sub
```

Grading

data2.xls

Sheet: Score

Column: j

Row: i

Nested loop

- Lets add grading student_ave()
- Modify so that it writes “Pass” or “Fail” into column O
- Pass if average >= 80
- Fail otherwise

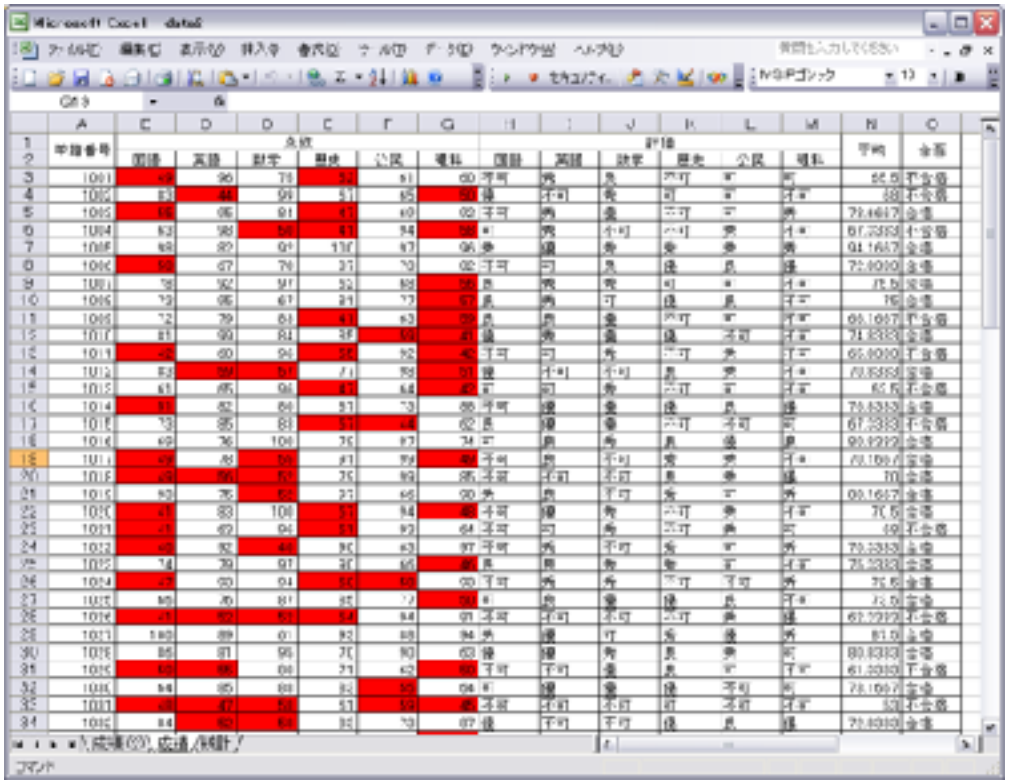
```
1   Sub student_ave()
2     Dim i As Integer
3     Dim j As Integer
4     Dim sum4 As Integer
5     Worksheets(“Score”).Activate
6
7     For i = 3 To 102
8       sum4 = 0
9       For j = 2 To 7
10        sum3 = sum3 + Cells(i, j)
11      Next j
12      Cells(i, j + 6) = sum4 / 6
13
14      If Cells(i, j+6) >= 80 Then
15        Cells(i, j+7) = “Pass”
16      Else
17        Cells(i, j+7) = “Fail”
18      End If
19    Next i
20  End Sub
```

Exercise

- Make a function that highlights cells with score below 60
- Name it Sub grade_6sub

Ex. Function to paint cell B3 red

```
1    Cells( 3 , 2 ).Interior.ColorIndex = 3
```



Add it into grade_6 sub

```
1   Sub grade_6sub()
2     Dim i As Integer
3     Dim j As Integer
4     Worksheets("Score").Activate
5     For j = 2 To 7
6       For i = 3 To 102
7         If Cells(i, 2) >= 90 Then
8           Cells(i, 8) = "A"
9         ElseIf Cells(i, 2) >= 80 Then
10          Cells(i, 8) = "B"
11        ElseIf Cells(i, 2) >= 70 Then
12          Cells(i, 8) = "C"
13        ElseIf Cells(i, 2) >= 60 Then
14          Cells(i, 8) = "D"
15        Else
16          Cells(i, 8) = "F"
17        End If
18      Next i
19    Next j
20  End Sub
```

data2.xls

Sheet: Score

Column: j

Row: i

Add "Cells(i , j).Interior.ColorIndex = 3"
into Sub grade_6sub()

Statistics
-Counting occurrences

Statistics - Pass and Fail

- Modify previous program to compute of “Pass” and “Fail” grades
- Report B12 and B13 on sheet “Statistics”
- Use after Sub student_ave()
  - Data input
    - Sheet “Score” O3 to O102
  - Data output
    - Sheet “Statistics” B12, B13
  - Prepare two variables for counting
    - Counter for “Pass”: pass
    - Counter for “Fail”: fail

```
1   Sub stat_pass_fail()
2     Dim i As Integer
3     Dim pass As Integer
4     Dim fail As Integer
5     Worksheets(“Score”).Activate
6
7     pass = 0
8     fail = 0
9
10    For i = 3 To 102
11      If Cells(i, 15) = “Pass” Then
12        pass = pass + 1
13      Elseif Cells(i, 15) = “Fail” Then
14        fail = fail + 1
15      End If
16    Next i
17
18    Worksheets(“Statistics”).Cells(12, 2) = pass
19    Worksheets(“Statistics”).Cells(13, 2) = fail
20  End Sub
```

Easy Exercise

- Make a new program to count grades
- Use Sub stat_pass_fail()to report grades
- Count subjects on sheet “Score” separately
- Report into cells B4:G8 on “Statistics”
  - Data input
    - Sheet “Score” H3 to M102
  - Data output
    - Sheet “Statistics” B4 to G8
  - Prepare five variables for counters
    - For A: a
    - For B: b
    - For C: c
    - For D: d
    - For F: f

```
Sub stat_grade()
  Dim i As Integer
  Dim j As Integer
  Dim a As Integer
  Dim b As Integer
  Dim c As Integer
  Dim d As Integer
  Dim f As Integer

  Worksheets(“Score”).Activate

  For i = 8 To 13
    a = 0
    b = 0
    c = 0
    d = 0
    f = 0
  For i = 3 To 102
    If Cells(i, 2) >= 90 Then
      Cells(i, 8) = “A”
    ElseIf Cells(i, 2) >= 80 Then
      Cells(i, 8) = “B”
    ElseIf Cells(i, 2) >= 70 Then
      Cells(i, 8) = “C”
    ElseIf Cells(i, 2) >= 60 Then
      Cells(i, 8) = “D”
    Else
      Cells(i, 8) = “F”
    End If
  Next i

  Worksheets(“Statistics”).Cells(4, j-6) = a
  Worksheets(“Statistics”).Cells(5, j-6) = b
  Worksheets(“Statistics”).Cells(6, j-6) = c
  Worksheets(“Statistics”).Cells(7, j-6) = d
  Worksheets(“Statistics”).Cells(8, j-6) = f
 Next j
End Sub
```

```
1   Sub stat_grade()
2     Dim i As Integer
3     Dim j As Integer
4     Dim a As Integer
5     Dim b As Integer
6     Dim c As Integer
7     Dim d As Integer
8     Dim f As Integer
9
10    Worksheets("Score").Activate
11
12    For i = 8 To 13
13      a = 0
14      b = 0
15      c = 0
16      d = 0
17      f = 0
18    For i = 3 To 102
19      If Cells(i, 2) >= 90 Then
20        Cells(i, 8) = "A"
21      ElseIf Cells(i, 2) >= 80 Then
22        Cells(i, 8) = "B"
23      ElseIf Cells(i, 2) >= 70 Then
24        Cells(i, 8) = "C"
25      ElseIf Cells(i, 2) >= 60 Then
26        Cells(i, 8) = "D"
27      Else
28        Cells(i, 8) = "F"
29      End If
30    Next i
31
32    Worksheets("Statistics").Cells(4, j-6) = a
33    Worksheets("Statistics").Cells(5, j-6) = b
34    Worksheets("Statistics").Cells(6, j-6) = c
35    Worksheets("Statistics").Cells(7, j-6) = d
36    Worksheets("Statistics").Cells(8, j-6) = f
37  Next j
38  End Sub
```

Can you do better?

Bonus Exercise

- Let's look for best student in each course
  - Highlight in green each highest score

  Beware! More than one student can win!

  HINT: use a counter
- Call it sub bestStudent()

BONUS: can you show the ids in a MsgBox?

情報基礎A
Lecture 12: Combining all together

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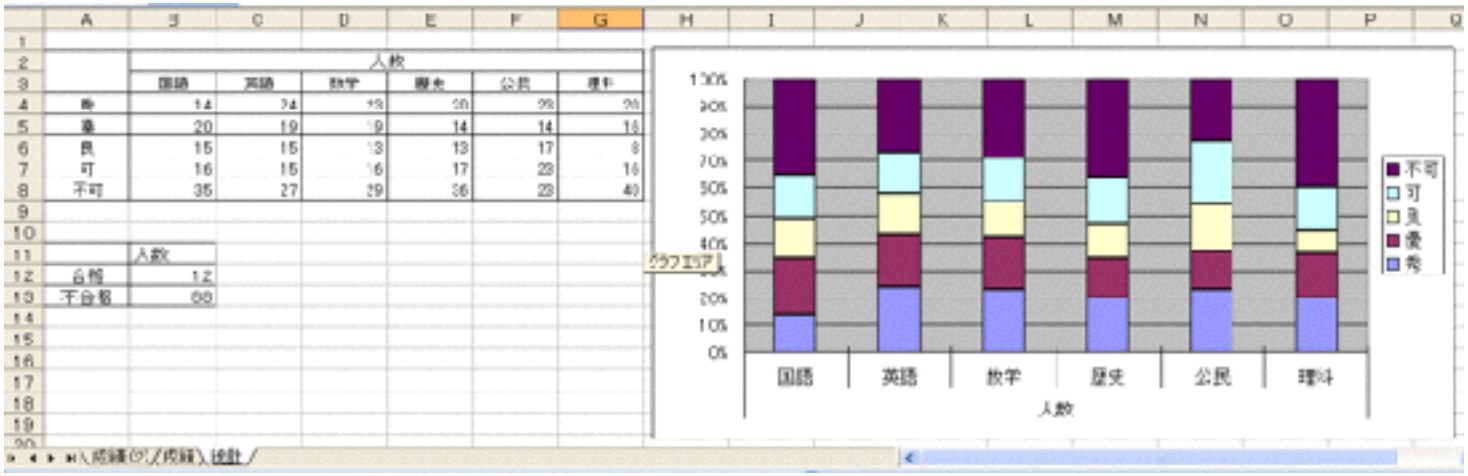
System Information Sciences
Design and Analysis of Information Systems

Inserting a table




```
1   Sub chart()
2
3     Worksheets(“Statistics”).Activate
4
5     Charts.Add
6     ActiveChart.ChartType = xlColumnStacked100
7     ActiveChart.SetSourceData Source := Sheets(“Statistics”).Range(“A2:G8”), PlotBy := xlRows
8     ActiveChart.Location Where := xlLocationAsObject, Name := “Statistics"
9   End Sub
```

Combining it all

- Make a procedure that computes:
  - Average score of each course
  - Total score of each course
  - Average score of each student
  - Give a A-E score per student per course
  - Give a global pass/fail per student
  - Computes the number of pass/fails per course
  - Makes a chart showing all of this information

Combining it all

- Make a procedure that computes:
  - Average score of each course
  - Total score of each course
  - Average score of each student
  - Give a A-E score per student per course
  - Give a global pass/fail per student
  - Computes the number of pass/fails per course
  - Makes a chart showing all of this information

Sounds Familiar?

Let's nest programs

- We have 6 separate programs that do so
  - Sub sum_ave_6sub()
  - Sub grade_6sub()
  - Sub student_ave()
  - Sub stat_pass_fail()
  - Sub stat_grade()
  - Sub chart()
  - Instead of copy/paste and fixing errors, let's make a program that calls all of them
  - Use Call "Procedure name"

Invoking other programs

- Procedures are executed in order

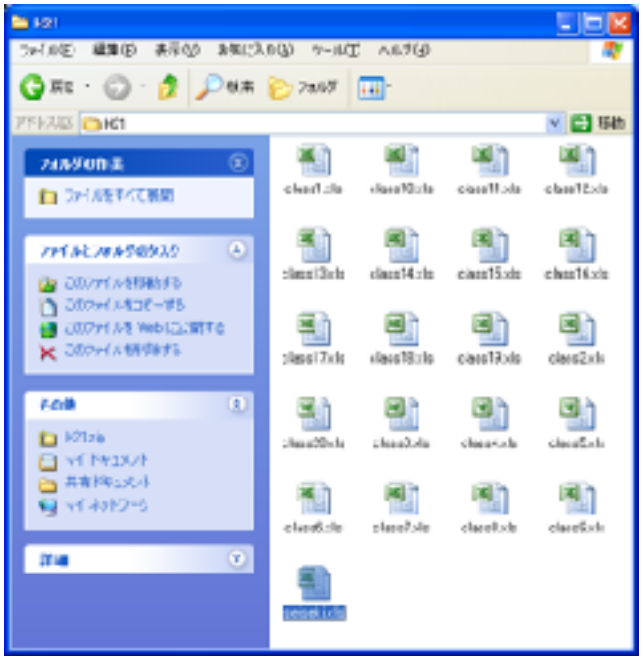
```
1   Sub score()
2
3     Call sum_ave_6sub
4     Call grade_6sub
5     Call student_ave
6     Call stat_pass_fail
7     Call stat_grade
8     Call chart
9
10  End Sub
```

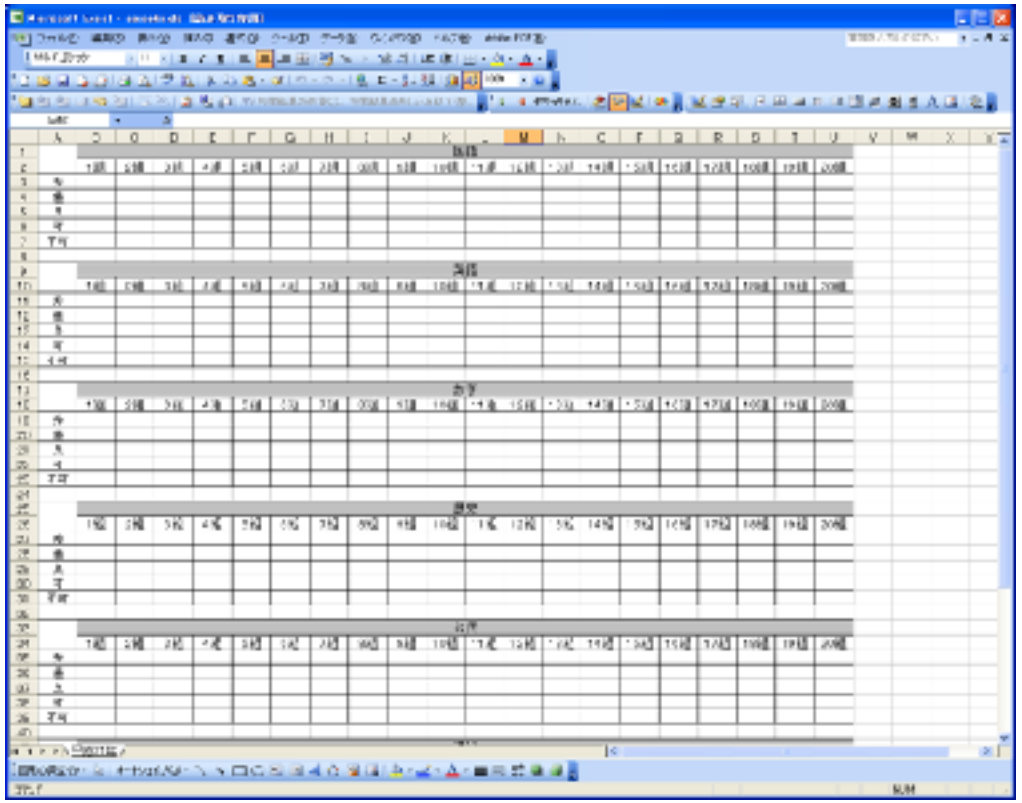
Processing several files at once

- Download collection of grades
- Available on my webpage
    - http://www.dais.is.tohoku.ac.jp/~mati/

Remember to make BACKUPS!!

Scores of 20 courses and 1 summary





Exercise

- We want to score all 20 courses
- We want a program that computes:
  - For each class
    - Average and sum per course
    - Score per student and global pass/fail
    - Statistics and chart on each course
    - charts, etc
  - Write statistics of 20 classes into score.xls

Unfeasible by hand!!

Operating files with VBA

- Opening one file

```
1    Workbooks.Open Filename := “class1.xls”
```

- Opening 20 files one by one
  - Must use variables to create filenames

```
1    For i= a To 20
2      Workbooks.Open Filename := “class” & i & “.xls”
3    Next i
```

- Saving and closing active file

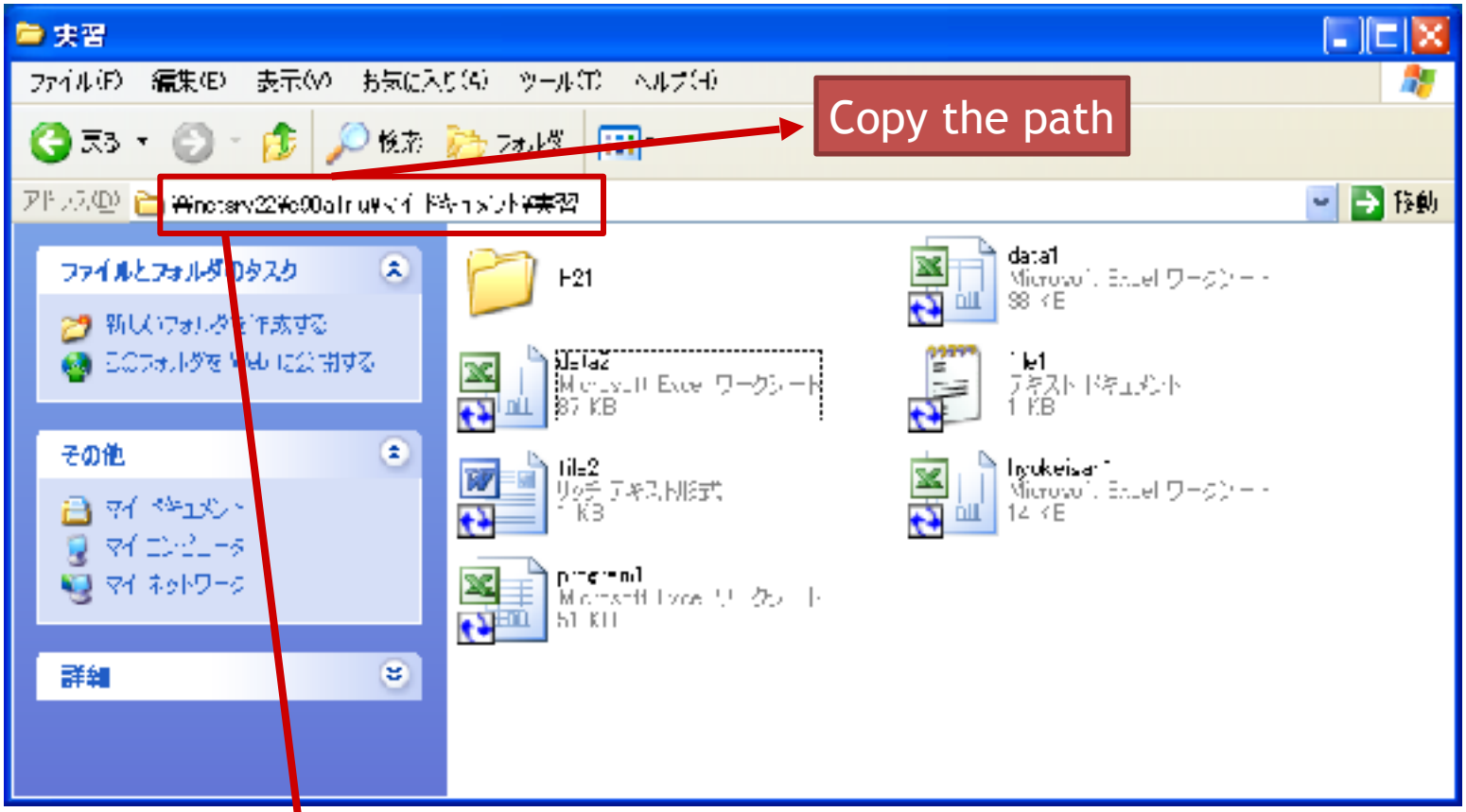
```
1    ActiveWorkbook.Save
2    ActiveWindow.Close
```

Accessing data from other files

- How can we copy cell the number who got “A” in Japanese on class3.xls onto seiseki.xls?
  - From cell B4 on sheet “Statistics” to B3 on score.xls

```
1  Workbooks("seiseki.xls").Worksheets("平成21年").Cells(3, 2) = Worksheets("統計").Cells(4, 2)
```

Be careful with file location!



```
Sub score()
  Dim i As Integer
  Dim m As Integer
  Dim n As Integer
  Dim x As Integer
  Workbooks.Open
  Filename:=“\\netsrv22\c90a1rlu\MyDocuments\foo\bar\baz.xls"
  For  i = 1 To 20
    Workbooks.Open Filename:="\\netsrv22\c90a1rlu\MyDocuments\foo\bar\class"  & i & ".xls"
    Call goukei_6kamoku
    Call hyouka_6kamoku
    Call kojin_heikin
    Call toukei_gouhi
    Call toukei_hyoka
    Call graph
    Workbooks(“baz.xls").Worksheets(“2011”).Cells(52, i + 1) = Worksheets(“Statistics”).Cells(12, 2)
    Workbooks(“baz.xls").Worksheets(“2011”).Cells(53, i + 1) = Worksheets(“Statistics”).Cells(13, 2)
    x = 0
    For   m =   1    To   6
      For   n =   2   To   6
        Workbooks("seiseki.xls").Worksheets(“2011").Cells(n+1+x,i+1)=Worksheets(“Statistics").Cells(n+2,m+1)
      Next  n
      x = x + 8
    Next  m
    ActiveWorkbook.Save
    ActiveWindow.Close
  Next i
  Workbooks("seiseki.xls").Save
End Sub
```

Submit your file

- mati@dais.is.tohoku.ac.jp
- Do not forget [KISO2017] in the subject
- Filename with your student ID
- **Deadline** 22nd January

Do not just copy!