Test design techniques (Part 1)

219343: Software Testing

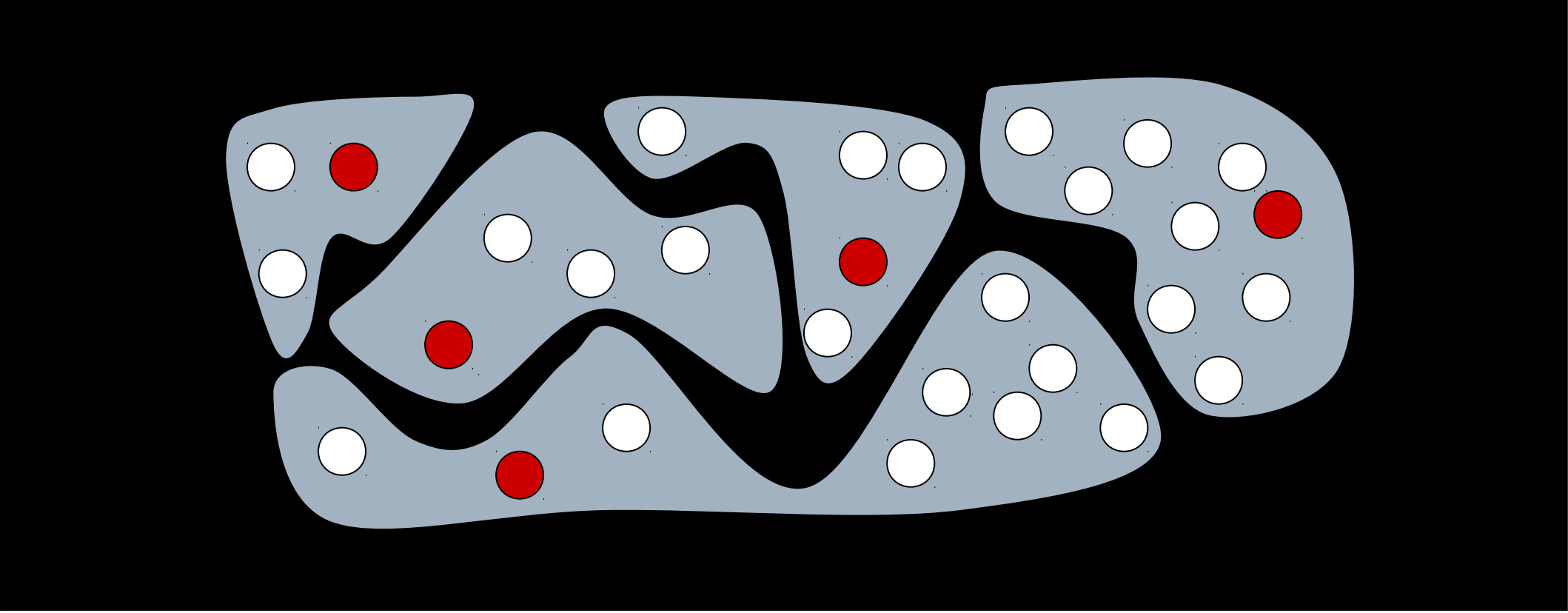
(Or, how to generate test cases)

White box / **black box**

Black box testing = testing with no internal knowledge of the software

Use only specification or requirement

Technique 1: Equivalence Class Testing



Partition the set of outputs into a set of equivalent behaviors

Ideally, you want to hit every sets.

Example: access control

The system maintains a list of users, and each user belong to groups.

Each element on the system has an owner and belongs to a single group.

The system has 3 basic levels of access control

- owner (u), group (g), and others (o)

Each element can also has a list of users with specific permission.

Example of permission

File: welcome.txt. Owner: jittat, **Group:** lecturer

Basic permission:

- **U – read, write**
- **G – read**
- **O – nothing**

Special permission:

- User: james – read, write
- User: john – read
- User: stefan – nothing
- Group: student – read

Want to test:

`CheckPermission(object, user, action)`

What are equivalence classes?

Write you test cases in form of table.

Equivalence classes:

- **C1:** an action is allowed because of the owner's permission
- **C2:** an action is allowed because of the group's permission
- **C3:** an action is allowed because of the others's permission
- **C4:** an action is allowed because of the special permission
- **C5:** an action is denied.

Example

Test data (or test fixture):

File: welcome.txt. Owner: jittat, **Group:** lecturer

Basic permission: U – read, write, G – read, O – nothing

#	User	Group	Object	Action	CheckPermission	Comments
C1	jittat	lecturer	welcome.txt	write	**Yes**	The owner can write.
2	tom	lecturer	welcome.txt	read	**Yes**	Group can read
3	tom	staff	welcome.txt	read	**No**	Others cannot read

Technique 2: Boundary Value Testing

Bugs often lie at the boundary

```
if(s>=80)
    print “A”
if(s>=70 and s<=80)
    print “B”
```

Example: calculating tax

เงินได้สุทธิไม่เกิน 150,000 บาท ยกเว้นภาษี

เงินได้สุทธิส่วนที่เกิน 150,000 บาท แต่ไม่เกิน 500,000 บาท ร้อยละ 10

เงินได้สุทธิส่วนที่เกิน 500,000 บาท แต่ไม่เกิน 1,000,000 บาท ร้อยละ 20

เงินได้สุทธิส่วนที่เกิน 1,000,000 บาท แต่ไม่เกิน 4,000,000 บาท ร้อยละ 30

เงินได้สุทธิส่วนที่เกิน 4,000,000 บาท ร้อยละ 37

Practices

- Consider KU student status.
- See info at: http://theory.cpe.ku.ac.th/wiki/index.php/01219343

Technique 3: Combinatorial Testing

Try all possible combinations

Start with a table listing all combinations

Conditions	Rule 1	Rule 2	Rule 3	Rule 4	Rule 5	Rule 6	Rule 7	Rule 8
GPA	4.0 – 3.0	2.99 – 2.0	4.0 – 3.0	2.99 – 2.0	4.0 – 3.0	2.99 – 2.0	D/C	D/C
House income (per year)	<100,000	<100,000	>=100,000	>=100,000	<100,000	<100,000	>=100,000	D/C
Activity records	>=5	>=5	>=5	>=5	<5	<5	<5	D/C
Advisor recommendation	yes	yes	yes	yes	yes	yes	yes	no
Actions								
Scholarship	30000	10000	10000	3000	5000	5000	0	0

Where are my test cases?

Usually, each rule becomes one test case.

Combinatorial Explosion

Question:

- if I have 4 conditions and each condition can be true or false, how many combinations do I have?
- what if I have 20 conditions.

Next, we'll learn pairwise testing technique which can be used to reduce the number of test cases.