8. Decision Tables

Structure and definitions
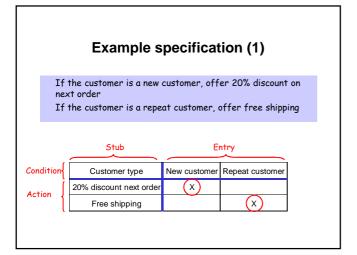Test cases
Semantics of (-)
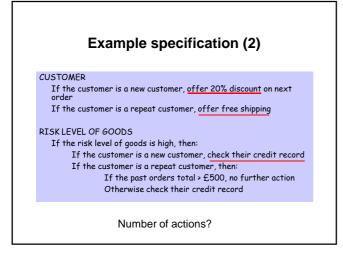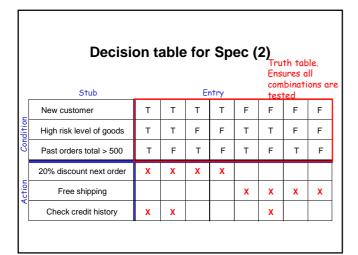Redundancy and inconsistency detection

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Decision tables

- Functional testing method

- Used when:
  - There are many possible combinations of conditions to test
  - There are multiple actions that should be taken under certain sets of conditions

- In practice -
  - When the specification has many nested IF – THEN – ELSE type conditions

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Example specification (1)

If the customer is a new customer, offer 20% discount on next order
If the customer is a repeat customer, offer free shipping

Condition / Action		New customer	Repeat customer
Condition	Customer type	New customer	Repeat customer
Action	20% discount next order	X	
Action	Free shipping		X

Stub — Entry

Example specification (2)

CUSTOMER
If the customer is a new customer, offer 20% discount on next order
If the customer is a repeat customer, offer free shipping

RISK LEVEL OF GOODS
If the risk level of goods is high, then:
    If the customer is a new customer, check their credit record
    If the customer is a repeat customer, then:
        If the past orders total > £500, no further action
        Otherwise check their credit record

Number of conditions?

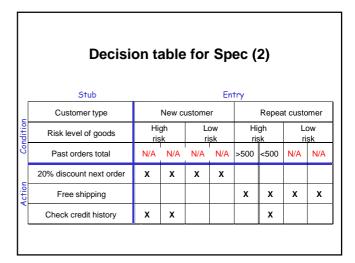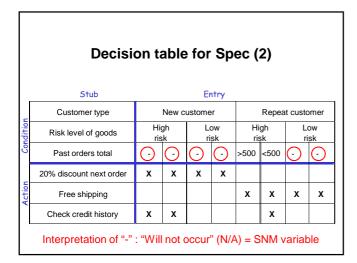---

Example specification (2)

CUSTOMER
If the customer is a new customer, offer 20% discount on next order
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RISK LEVEL OF GOODS
If the risk level of goods is high, then:
    If the customer is a new customer, check their credit record
    If the customer is a repeat customer, then:
        If the past orders total > £500, no further action
        Otherwise check their credit record

Number of actions?

Decision table for Spec (2)

		New customer				Repeat customer			
Condition	Customer type	New customer				Repeat customer			
Condition	Risk level of goods	High risk		Low risk		High risk		Low risk	
Condition	Past orders total	>500	<500	>500	<500	>500	<500	>500	<500
Action	20% discount next order	X	X	X	X				
Action	Free shipping					X	X	X	X
Action	Check credit history	X	X				X		

Stub — Entry

1

Decision table for Spec (2)

Truth table. Ensures all combinations are tested

	Stub		Entry						
Condition	New customer	T	T	T	T	F	F	F	F
	High risk level of goods	T	T	F	F	T	T	F	F
	Past orders total > 500	T	F	T	F	T	F	T	F
Action	20% discount next order	X	X	X	X				
	Free shipping					X	X	X	X
	Check credit history	X	X				X		

Decision table for Spec (2)

	Stub		Entry						
Condition	Customer type		New customer			Repeat customer			
	Risk level of goods	High risk		Low risk		High risk		Low risk	
	Past orders total	N/A	N/A	N/A	N/A	>500	<500	N/A	N/A
Action	20% discount next order	X	X	X	X				
	Free shipping					X	X	X	X
	Check credit history	X	X				X		

Decision table for Spec (2)

	Stub		Entry						
Condition	Customer type		New customer			Repeat customer			
	Risk level of goods	High risk		Low risk		High risk		Low risk	
	Past orders total	-	-	-	-	>500	<500	-	-
Action	20% discount next order	X	X	X	X				
	Free shipping					X	X	X	X
	Check credit history	X	X				X		

Interpretation of "-" : "Will not occur" (N/A) = SNM variable

Decision tables and testing

Input variables   Equivalence classes

	Stub		Entry						
Condition	Customer type		New customer			Repeat customer			
	Risk level of goods	High risk		Low risk		High risk		Low risk	
	Past orders total	-	-	-	-	>500	<500	-	-
Action	20% discount next order	X	X	X	X				
	Free shipping					X	X	X	X
	Check credit history	X	X				X		

Expected outputs

Decision tables and testing

Each column defines a test case

New customer	T	T	T	T	F	F	F	F
High risk level of goods	T	T	F	F	T	T	F	F
Past orders total > 500	(T)	(F)	(T)	(F)	T	F	(T)	(F)
20% discount next order	X	X	X	X				
Free shipping					X	X	X	X
Check credit history	X	X				X		

Decision table for the Triangle problem

a=b	T	T	T	T	F	F	F	F
b=c	T	T	F	F	T	T	F	F
a=c	T	F	T	F	T	F	T	F
Scalene								X
Isosceles				X		X	X	
Equilateral	X							
Impossible		X	X		X			

Decision table for the Triangle problem

a,b,c form a triangle	F	F	F	F	F	F	F	F	T	T	T	T	T	T	T	T
a=b	T	T	T	T	F	F	F	F	T	T	T	T	F	F	F	F
b=c	T	T	F	F	T	T	F	F	T	T	F	F	T	T	F	F
a=c	T	F	T	F	T	F	T	F	T	F	T	F	T	F	T	F
Not a triangle	X	X	X	X	X	X	X	X								
Scalene																X
Isosceles											X		X	X		
Equilateral									X							
Impossible										X	X		X			

Decision table for the Triangle problem

a,b,c form a triangle		T	T	T	T	T	T	T	T
a = b		T	T	T	T	F	F	F	F
a = c		T	T	F	F	T	T	F	F
b = c		T	F	T	F	T	F	T	F
Not a triangle									
Scalene									X
Isosceles				X		X	X		
Equilateral	X								
Impossible		X	X		X				

Decision table for the Triangle problem

a,b,c form a triangle	F	T	T	T	T	T	T	T	T
a = b	-	T	T	T	T	F	F	F	F
a = c	-	T	T	F	F	T	T	F	F
b = c	-	T	F	T	F	T	F	T	F
Not a triangle	X								
Scalene									X
Isosceles					X		X	X	
Equilateral		X							
Impossible			X	X		X			

Semantics of (-)

a,b,c form a triangle	F	T	T	T	T	T	T	T	T
a = b	-	T	T	T	T	F	F	F	F
a = c	-	T	T	F	F	T	T	F	F
b = c	-	T	F	T	F	T	F	T	F
Not a triangle	X								

Don't care

Interpretation: "Will not occur" (N/A)

Semantics of (-)

Month with 31 days	T	-	-
Month with 30 days	-	T	-
February	-	-	T
a1:			
a2:			
a3:			

Mutually exclusive

Interpretation: "must be False" (alternative notation: F!)
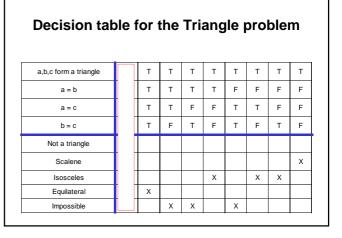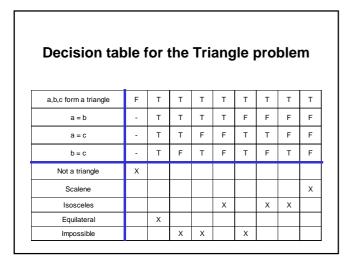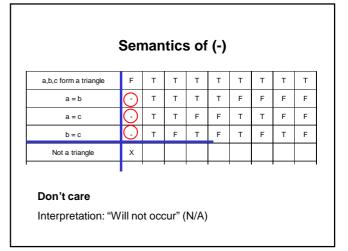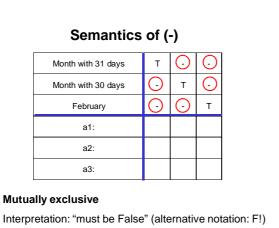
Limited and extended entry

Limited Entry Decision Tables
- All conditions are binary (i.e. either T or F)
- Every possible combination of condition values is guaranteed to be tested
- The number of tests: 2^N, where N is the number of variables

Extended Entry Decision Tables
- Conditions are allowed to have several values
- Can be expanded to Limited Entry Tables

Redundancy detection

New customer	T	T	T	T	F	F	F	F
High risk level of goods	T	T	F	F	T	T	F	F
Past orders total > 500	-	-	-	-	T	F	-	-
20% discount next order	X	X	X	X				
Free shipping						X	X	X	X
Check credit history	X	X				X		

- Naïve count of the number of tests (3 variables): $2^N = 2^3 = 8$
- Can be reduced to **5**

Decision table for Spec (2)

Customer type	New customer		Repeat customer	
Risk level of goods	High risk	Low risk	High risk	Low risk
Past orders total	-	-	>500	<500	-
20% discount next order	**X**	**X**		
Free shipping			**X**	**X**	**X**
Check credit history	**X**			**X**

Inconsistency detection

c1:	T	F	F	F	F	T
c2:	-	T	T	F	F	F
c3:	-	T	F	T	F	F
a1:	X	X	X			
a2:		X	X	X		X
a3:	X		X	X	X	

Different sets of actions for the same set of conditions

Recommendations for the use of the Decision Tables

- Prominent if-then-else logic
- Logical relationships among input variables
- Calculations involving subsets of the input variables
- Cause-and-effect relationship between inputs and outputs
- High cyclomatic complexity

- When a table grows too complex, factor it into smaller ones

Next lecture

Path testing