國立清華大學 電機工程學系碩博士班
103 學年度第一學期
EE-6250 超大型積體電路測試 VLSI Testing
期末考 Jan. 14, 2015 (總分 100 分)
(Closed-Book Examination)

1. (20%) Answer the following questions.
   (a) Explain the **aliasing problem** in a logic BIST method. (5%)
   (b) **Test compression** is often used in a typical modern test flow. Give one benefit it can provide in addition to the reduction of the test memory requirement. (5%)
   (c) There are two basic requirements to produce (2^n-1) **pseudo random patterns** using an n-stage LFSR. One of them is to choose a LFSR with a primitive (or irreducible) polynomial. Name the other requirement. (5%)
   (d) Consider a test pattern split into four sub-patterns (one for each of four scan chains): {Chain1=(101XX), Chain2=(XX10X), Chain3=(XXX0X), Chain4=(1XXX1), Chain5=(XXXX1)}. If the **broadcasting scan test** is to be applied, then what scan pattern need to be broadcast to the 5 scan chains concurrently? (5%)

2. (10%) Answer the following questions.
   (a) There are 5 basic input/output signals used in **IEEE Std. 1149.1**. What are them? (5%)
   (b) A Boundary Scan Cell (BSC) in IEEE Std. 1149.1 is controlled by three important control signals, namely *ClockDR*, *ShiftDR*, and *UpdateDR*. For a BSC at a chip's output pin, which signal will determine the timing of data latching from the interconnect? (5%)

3. (10%) Consider the **Hoffman encoding** for a set of test patterns containing 5 symbols {A=0001, B=0010, C=0100, D=1000, E=1111} with their occurrence frequencies shown in the table below.
   (a) Construct a binary tree for the Hoffman encoding, with the accumulated number of occurrences labeled in each node. (5%)
   (b) Before the Hoffman encoding, the original number of bits to represent this set of test patterns is (10+20+30+40+100)* 4 = 800. What is the total number of bits after the Hoffman encoding? (5%)

Symbol ID	Pattern	Number of occurrences in the test patterns
A	(0001)	10
B	(0010)	20
C	(0100)	30
D	(1000)	40
E	(1111)	100

4. (10%) Consider the **linear-decompression scheme** characterized by a de-compressor as shown below. Fill in the missing rows in its matrix form.