Name: KEY **Id#**

COE 405, Term 031

Design & Modeling of Digital Systems

Quiz# 4

Date: Tuesday, Dec. 23, 2003

Q.1. Given the following Entity Description for a JK Flip-Flop:

```
ENTITY JKFF IS
GENERIC (delay : TIME := 4 NS);
PORT (j, k, clk, reset : IN BIT; q, qb : OUT BIT);
END JKFF;
```

(i) Model the JK-FF using a BLOCK statement with a GUARD expression and conditional signal assignment, assuming that reset is synchronous and the JK-FF is rising-edge triggered.

```
Architecture Sreset of JKFF is
begin
edge: BLOCK ( clk = '1' AND NOT clk'STABLE )
   BEGIN
        q <= GUARDED '0' after delay when reset = '1'  else '1' after delay when
        j='1' and k='0' else '0' after delay when j='0' and k='1' else not q after delay
        when j='1' and k='1' else q;
        qb <=  NOT q;
   END BLOCK;
 end Sreset;
```

(ii) Model the JK-FF using a BLOCK statement with a GUARD expression and slective signal assignment, assuming that reset is synchronous and the JK-FF is rising-edge triggered.

```
Architecture Sreset2 of JKFF is
        signal s : bit_vector(2 downto 0);
begin

s <= reset & j & k;
```

```
edge: BLOCK ( clk = '1' AND NOT clk'STABLE )
    BEGIN
      with s select
         q <= GUARDED '0' after delay when "001",
                    '1' after delay when "010",
                    not q after delay when "011",
                    q after delay when "000",
                    '0' after delay when others;
         qb <=  NOT q;
    END BLOCK;
 end Sreset2;
```

(iii) Model the JK-FF using a BLOCK statement with a GUARD expression and conditional signal assignment, assuming that reset is <u>asynchronous</u> and the JK-FF is rising-edge triggered.

```
Architecture ASreset of JKFF is
begin

edge: BLOCK ( reset='1' OR (clk = '1' AND NOT clk'STABLE ) )
    BEGIN
         q <= GUARDED '0' after delay when reset = '1'  else '1' after delay when
j='1' and k='0' else '0' after delay when j='0' and k='1' else not q after delay when
j='1' and k='1' else q;
         qb <=  NOT q;
    END BLOCK;

 end ASreset;
```