Laboratórna úloha číslo 7

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GitHub:

Link repozitára: https://github.com/DaNNym99/Digital-electronics-1

1. Pravdivostne tabulky

1.1. D-ff

D	Qn	Q(n+1)	Comments
0	0	0	Zapis pri nabeznej hrane
0	1	0	Zapis pri nabeznej hrane
1	0	1	Zapis pri nabeznej hrane
1	1	1	Zapis pri nabeznej hrane

1.2. JK-ff

J	K	Qn	Q(n+1)	Comments
0	0	0	0	No change
0	0	1	1	No change
0	1	0	0	Reset
0	1	1	0	Reset
1	0	0	1	Set
1	0	1	1	Set
1	1	0	1	Invertor
1	1	1	0	Invertor

1.2. T-ff

T	Qn	Q(n+1)	Comments
0	0	0	Pamatanie
0	1	1	Pamatanie
1	0	1	Invertor
1	1	0	Invertor

1.3. Rovnice

$$jk \quad Q(next) = J\bar{Q} + \bar{K}Q$$

$$d \quad Q(next) = D$$

$$t \quad Q(next) = T\bar{Q} + \bar{T}Q$$

2. D-latch

2.1. Proces p_d_latch

```
p_d_latch : process (d, arst, en)
    begin
        if (arst = '1') then
            q <= '0';
            q_bar <= '0';
        elsif (en ='1')then
            q <= d;
            q_bar <= not d;

        end if;
    end process p_d_latch;
```

2.2. Súbor tb_d_latch.vhdl

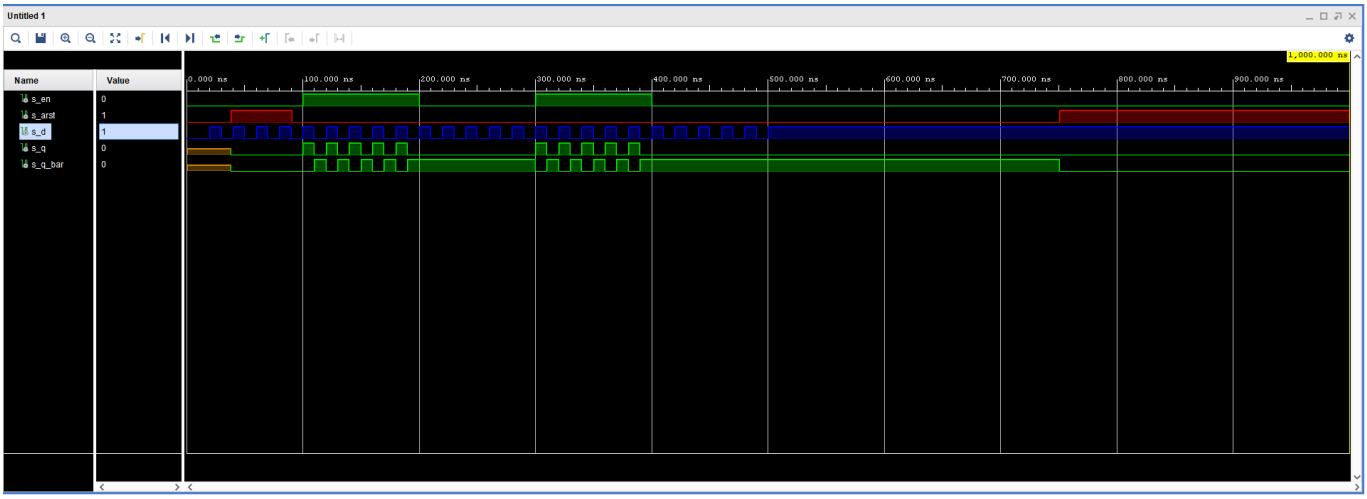
```
 p_reset : process
    begin
        s_arst <= '0';
        wait for 38 ns;
        s_arst <= '1';
        wait for 53 ns;
        -- Reset activated
        s_arst <= '0';
        wait for 660 ns;
        s_arst <= '1';
        wait;

 p_stimulus : process
    begin
        report "Stimulus process started" severity note;
            s_d <= '0';
            s_en <= '0';

            assert(s_q ='0')
            report "" severity error;
```

```
        wait for 10ns;
        s_d <= '0';
        wait for 10ns;
        s_d <= '1';
        wait for 10ns;
        s_d <= '0';
        wait for 10ns;
        s_d <= '1';
        wait for 10ns;
        s_d <= '0';
        wait for 10ns;
        s_d <= '1';
        wait for 10ns;
        s_d <= '0';
        wait for 10ns;
        s_d <= '1';
        wait for 10ns;
        s_d <= '0';
        wait for 10ns;
        s_d <= '1';

        s_en <= '1';
        wait for 10ns;
        s_d <= '0';
        wait for 10ns;
        s_d <= '1';
        wait for 10ns;
        s_d <= '0';
        wait for 10ns;
        s_d <= '1';
        wait for 10ns;
        s_d <= '0';
        wait for 10ns;
        s_d <= '1';
        wait for 10ns;
        s_d <= '0';
        wait for 10ns;
        s_d <= '1';
        wait for 10ns;
        s_d <= '0';
        wait for 10ns;
        s_d <= '1';

        s_en <= '0';
        wait for 10ns;
        s_d <= '0';
        wait for 10ns;
        s_d <= '1';
        wait for 10ns;
        s_d <= '0';
        wait for 10ns;
        s_d <= '1';
        wait for 10ns;
```

```
        s_d <= '0';
        wait for 10ns;
        s_d <= '1';
        wait for 10ns;
        s_d <= '0';
        wait for 10ns;
        s_d <= '1';
        wait for 10ns;
        s_d <= '0';
        wait for 10ns;
        s_d <= '1';

        s_en <= '1';
        wait for 10ns;
        s_d <= '0';
        wait for 10ns;
        s_d <= '1';
        wait for 10ns;
        s_d <= '0';
        wait for 10ns;
        s_d <= '1';
        wait for 10ns;
        s_d <= '0';
        wait for 10ns;
        s_d <= '1';
        wait for 10ns;
        s_d <= '0';
        wait for 10ns;
        s_d <= '1';
        wait for 10ns;
        s_d <= '0';
        wait for 10ns;
        s_d <= '1';

        s_en <= '0';
        wait for 10ns;
        s_d <= '0';
        wait for 10ns;
        s_d <= '1';
        wait for 10ns;
        s_d <= '0';
        wait for 10ns;
        s_d <= '1';
        wait for 10ns;
        s_d <= '0';
        wait for 10ns;
        s_d <= '1';
        wait for 10ns;
        s_d <= '0';
        wait for 10ns;
        s_d <= '1';
        wait for 10ns;
        s_d <= '0';
        wait for 10ns;
```

```
            s_d <= '1';



        report "Stimulus process finished" severity note;
        wait;
    end process p_stimulus;
```

2.3. Vystup symulácie



3. Hradlá

3.1. Proces p_d_ff_arst

```
    p_d_ff_arst : process (arst, clk)
    begin
        if (arst = '1') then
            q <= '0';
            q_bar <= '1';
        elsif rising_edge(clk) then
            q <= d;
            q_bar <= not d;

        end if;
    end process p_d_ff_arst;
```

3.2. Proces p_d_ff_rst

```
    p_d_ff_rst : process (clk)
    begin
        if rising_edge(clk) then
            if (rst = '1')then
                s_q <= '0';
            else
                if rising_edge(clk) then
```

```
                    s_q <= d;
                end if;
            end if;
        end if;
    end process p_d_ff_rst;
```

3.3. Proces p_jk_ff_rst

```
    p_jk_ff_rst : process ( clk)
    begin
        if rising_edge(clk) then
            if (rst = '1')then
                s_q <= '0';
            else
                if(j = '0' and k = '0')then
                    s_q <= s_q;
                elsif(j = '0' and k = '1')then
                    s_q <= '0';
                elsif(j = '1' and k = '0')then
                    s_q <= '1';
                else
                    s_q <= not s_q;
                end if;
            end if;
        end if;
    end process p_jk_ff_rst;
```

3.4. Proces p_t_ff_rst

```
    p_t_ff_rst : process (clk)
    begin
        if rising_edge(clk) then
            if (rst = '1')then
                s_q <= '0';
            else
                if(t = '0')then
                    s_q <= s_q;
                elsif(t = '1')then
                    s_q <= not s_q;
               end if;
            end if;
        end if;
    end process p_t_ff_rst;
```

3.5. Súbor tb_p_d_ff_arst

```
    p_reset : process
     begin
         s_arst <= '0';
         wait for 25 ns;
         s_arst <= '1';
         wait for 55 ns;
         -- Reset activated
         s_arst <= '0';
         wait for 108 ns;
         s_arst <= '1';
         wait for 202 ns;
         -- Reset activated
         s_arst <= '0';
         wait for 660 ns;
         s_arst <= '1';
         wait;

     end process p_reset;

     p_stimulus : process
     begin
         report "Stimulus process started" severity note;
             s_d <= '0';

             assert(s_q ='0')
             report "" severity error;


             wait for 10ns;
             s_d <= '0';
             wait for 10ns;
             s_d <= '1';
             wait for 10ns;
             s_d <= '0';
             wait for 10ns;
             s_d <= '1';
             wait for 10ns;
             s_d <= '0';
             wait for 10ns;
             s_d <= '1';
             wait for 10ns;
             s_d <= '0';
             wait for 10ns;
             s_d <= '1';
             wait for 10ns;
             s_d <= '0';
             wait for 10ns;
             s_d <= '1';

             wait for 10ns;
             s_d <= '0';
             wait for 10ns;
             s_d <= '1';
```

```
        wait for 10ns;
        s_d <= '0';
        wait for 10ns;
        s_d <= '1';
        wait for 10ns;
        s_d <= '0';
        wait for 10ns;
        s_d <= '1';
        wait for 10ns;
        s_d <= '0';
        wait for 10ns;
        s_d <= '1';
        wait for 10ns;
        s_d <= '0';
        wait for 10ns;
        s_d <= '1';

        wait for 10ns;
        s_d <= '0';
        wait for 10ns;
        s_d <= '1';
        wait for 10ns;
        s_d <= '0';
        wait for 10ns;
        s_d <= '1';
        wait for 10ns;
        s_d <= '0';
        wait for 10ns;
        s_d <= '1';
        wait for 10ns;
        s_d <= '0';
        wait for 10ns;
        s_d <= '1';
        wait for 10ns;
        s_d <= '0';
        wait for 10ns;
        s_d <= '1';

        wait for 10ns;
        s_d <= '0';
        wait for 10ns;
        s_d <= '1';
        wait for 10ns;
        s_d <= '0';
        wait for 10ns;
        s_d <= '1';
        wait for 10ns;
        s_d <= '0';
        wait for 10ns;
        s_d <= '1';
        wait for 10ns;
        s_d <= '0';
        wait for 10ns;
        s_d <= '1';
```

```
        wait for 10ns;
        s_d <= '0';
        wait for 10ns;
        s_d <= '1';

        wait for 10ns;
        s_d <= '0';
        wait for 10ns;
        s_d <= '1';
        wait for 10ns;
        s_d <= '0';
        wait for 10ns;
        s_d <= '1';
        wait for 10ns;
        s_d <= '0';
        wait for 10ns;
        s_d <= '1';
        wait for 10ns;
        s_d <= '0';
        wait for 10ns;
        s_d <= '1';
        wait for 10ns;
        s_d <= '0';
        wait for 10ns;
        s_d <= '1';

        wait for 10ns;
        s_d <= '0';
        wait for 10ns;
        s_d <= '1';
        wait for 10ns;
        s_d <= '0';
        wait for 10ns;
        s_d <= '1';
        wait for 10ns;
        s_d <= '0';
        wait for 10ns;
        s_d <= '1';
        wait for 10ns;
        s_d <= '0';
        wait for 10ns;
        s_d <= '1';
        wait for 10ns;
        s_d <= '0';
        wait for 10ns;
        s_d <= '1';

        wait for 10ns;
        s_d <= '0';
        wait for 10ns;
        s_d <= '1';
        wait for 10ns;
        s_d <= '0';
        wait for 10ns;
        s_d <= '1';
        wait for 10ns;
```

```
            s_d <= '1';
            wait for 10ns;
            s_d <= '0';
            wait for 10ns;
            s_d <= '1';
            wait for 10ns;
            s_d <= '0';
            wait for 10ns;
            s_d <= '1';
            wait for 10ns;
            s_d <= '0';
            wait for 10ns;
            s_d <= '1';

            wait for 10ns;
            s_d <= '0';
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            s_d <= '0';
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            s_d <= '1';
            wait for 10ns;
            s_d <= '0';
            wait for 10ns;
            s_d <= '1';
            wait for 10ns;
            s_d <= '0';
            wait for 10ns;
            s_d <= '1';

            wait for 10ns;
            s_d <= '0';
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            s_d <= '1';
            wait for 10ns;
            s_d <= '0';
            wait for 10ns;
            s_d <= '1';
            wait for 10ns;
            s_d <= '0';
            wait for 10ns;
            s_d <= '1';
            wait for 10ns;
            s_d <= '0';
            wait for 10ns;
            s_d <= '1';
            wait for 10ns;
            s_d <= '0';
            wait for 10ns;
```

```
            s_d <= '1';

            wait for 10ns;
            s_d <= '0';
            wait for 10ns;
            s_d <= '1';
            wait for 10ns;
            s_d <= '0';
            wait for 10ns;
            s_d <= '1';
            wait for 10ns;
            s_d <= '0';
            wait for 10ns;
            s_d <= '1';
            wait for 10ns;
            s_d <= '0';
            wait for 10ns;
            s_d <= '1';
            wait for 10ns;
            s_d <= '0';
            wait for 10ns;
            s_d <= '1';

            wait for 10ns;
            s_d <= '0';
            wait for 10ns;
            s_d <= '1';
            wait for 10ns;
            s_d <= '0';
            wait for 10ns;
            s_d <= '1';
            wait for 10ns;
            s_d <= '0';
            wait for 10ns;
            s_d <= '1';
            wait for 10ns;
            s_d <= '0';
            wait for 10ns;
            s_d <= '1';
            wait for 10ns;
            s_d <= '0';
            wait for 10ns;
            s_d <= '1';

        report "Stimulus process finished" severity note;
        wait;
    end process p_stimulus;
```

3.6. Súbor tb_p_d_ff_rst

```
    p_reset : process
     begin
         s_rst <= '0';
         wait for 25 ns;
         s_rst <= '1';
         wait for 55 ns;
         -- Reset activated
         s_rst <= '0';
         wait for 660 ns;
         s_rst <= '1';
         wait;
     end process p_reset;

      p_stimulus : process
     begin
         report "Stimulus process started" severity note;

             s_d <= '0';

             assert(s_q ='0')
             report "" severity error;


             s_d <= '0';
             wait for 10ns;
             s_d <= '1';
             wait for 15ns;
             s_d <= '0';
             wait for 15ns;
             s_d <= '1';
             wait for 5ns;
             s_d <= '0';
             wait for 15ns;
             s_d <= '1';
             wait for 20ns;
             s_d <= '0';
             wait for 10ns;

             s_d <= '0';
             wait for 10ns;
             s_d <= '1';
             wait for 15ns;
             s_d <= '0';
             wait for 15ns;
             s_d <= '1';
             wait for 5ns;
             s_d <= '0';
             wait for 15ns;
             s_d <= '1';
             wait for 20ns;
             s_d <= '0';
             wait for 10ns;
```

```
        s_d <= '0';
        wait for 10ns;
        s_d <= '1';
        wait for 15ns;
        s_d <= '0';
        wait for 15ns;
        s_d <= '1';
        wait for 5ns;
        s_d <= '0';
        wait for 15ns;
        s_d <= '1';
        wait for 20ns;
        s_d <= '0';
        wait for 10ns;

        s_d <= '0';
        wait for 10ns;
        s_d <= '1';
        wait for 15ns;
        s_d <= '0';
        wait for 15ns;
        s_d <= '1';
        wait for 5ns;
        s_d <= '0';
        wait for 15ns;
        s_d <= '1';
        wait for 20ns;
        s_d <= '0';
        wait for 10ns;

        s_d <= '0';
        wait for 10ns;
        s_d <= '1';
        wait for 15ns;
        s_d <= '0';
        wait for 15ns;
        s_d <= '1';
        wait for 5ns;
        s_d <= '0';
        wait for 15ns;
        s_d <= '1';
        wait for 20ns;
        s_d <= '0';
        wait for 10ns;

        s_d <= '0';
        wait for 10ns;
        s_d <= '1';
        wait for 15ns;
        s_d <= '0';
        wait for 15ns;
        s_d <= '1';
        wait for 5ns;
        s_d <= '0';
```

```
        wait for 15ns;
        s_d <= '1';
        wait for 20ns;
        s_d <= '0';
        wait for 10ns;

        s_d <= '0';
        wait for 10ns;
        s_d <= '1';
        wait for 15ns;
        s_d <= '0';
        wait for 15ns;
        s_d <= '1';
        wait for 5ns;
        s_d <= '0';
        wait for 15ns;
        s_d <= '1';
        wait for 20ns;
        s_d <= '0';
        wait for 10ns;

        s_d <= '0';
        wait for 10ns;
        s_d <= '1';
        wait for 15ns;
        s_d <= '0';
        wait for 15ns;
        s_d <= '1';
        wait for 5ns;
        s_d <= '0';
        wait for 15ns;
        s_d <= '1';
        wait for 20ns;
        s_d <= '0';
        wait for 10ns;

        s_d <= '0';
        wait for 10ns;
        s_d <= '1';
        wait for 15ns;
        s_d <= '0';
        wait for 15ns;
        s_d <= '1';
        wait for 5ns;
        s_d <= '0';
        wait for 15ns;
        s_d <= '1';
        wait for 20ns;
        s_d <= '0';
        wait for 10ns;

        s_d <= '0';
        wait for 10ns;
        s_d <= '1';
```

```
            wait for 15ns;
            s_d <= '0';
            wait for 15ns;
            s_d <= '1';
            wait for 5ns;
            s_d <= '0';
            wait for 15ns;
            s_d <= '1';
            wait for 20ns;
            s_d <= '0';
            wait for 10ns;

            s_d <= '0';
            wait for 10ns;
            s_d <= '1';
            wait for 15ns;
            s_d <= '0';
            wait for 15ns;
            s_d <= '1';
            wait for 5ns;
            s_d <= '0';
            wait for 15ns;
            s_d <= '1';
            wait for 20ns;
            s_d <= '0';
            wait for 10ns;

        report "Stimulus process finished" severity note;
        wait;
     end process p_stimulus;
```

3.7. Súbor tb_p_jk_ff_rst

```
    p_reset : process
     begin
         s_rst <= '0';
         wait for 25 ns;
         s_rst <= '1';
         wait for 55 ns;
         -- Reset activated
         s_rst <= '0';
         wait for 660 ns;
         s_rst <= '1';
         wait;

     end process p_reset;

     p_stimulus : process
     begin
         report "Stimulus process started" severity note;
```

```
        s_j <= '0';
        s_k <= '0';

        assert(s_q ='0')
        report "" severity error;


        s_j <= '0';
        s_k <= '0';
        wait for 10ns;
        s_j <= '1';
        s_k <= '0';
        wait for 15ns;
        s_j <= '0';
        s_k <= '0';
        wait for 15ns;
        s_j <= '0';
        s_k <= '1';
        wait for 5ns;
        s_j <= '0';
        s_k <= '0';
        wait for 15ns;
        s_j <= '1';
        s_k <= '1';
        wait for 20ns;
        s_j <= '0';
        s_k <= '0';
        wait for 10ns;
        s_j <= '0';
        s_k <= '0';
        wait for 10ns;
        s_j <= '1';
        s_k <= '0';
        wait for 15ns;
        s_j <= '0';
        s_k <= '0';
        wait for 15ns;
        s_j <= '0';
        s_k <= '1';
        wait for 5ns;
        s_j <= '0';
        s_k <= '0';
        wait for 15ns;
        s_j <= '1';
        s_k <= '1';
        wait for 20ns;
        s_j <= '0';
        s_k <= '0';
        wait for 10ns;
        s_j <= '0';
        s_k <= '0';
        wait for 10ns;
        s_j <= '1';
        s_k <= '0';
```

```
        wait for 15ns;
        s_j <= '0';
        s_k <= '0';
        wait for 15ns;
        s_j <= '0';
        s_k <= '1';
        wait for 5ns;
        s_j <= '0';
        s_k <= '0';
        wait for 15ns;
        s_j <= '1';
        s_k <= '1';
        wait for 20ns;
        s_j <= '0';
        s_k <= '0';
        wait for 10ns;
        s_j <= '0';
        s_k <= '0';
        wait for 10ns;
        s_j <= '1';
        s_k <= '0';
        wait for 15ns;
        s_j <= '0';
        s_k <= '0';
        wait for 15ns;
        s_j <= '0';
        s_k <= '1';
        wait for 5ns;
        s_j <= '0';
        s_k <= '0';
        wait for 15ns;
        s_j <= '1';
        s_k <= '1';
        wait for 20ns;
        s_j <= '0';
        s_k <= '0';
        wait for 10ns;
        s_j <= '0';
        s_k <= '0';
        wait for 10ns;
        s_j <= '1';
        s_k <= '0';
        wait for 15ns;
        s_j <= '0';
        s_k <= '0';
        wait for 15ns;
        s_j <= '0';
        s_k <= '1';
        wait for 5ns;
        s_j <= '0';
        s_k <= '0';
        wait for 15ns;
        s_j <= '1';
        s_k <= '1';
```

```
        wait for 20ns;
        s_j <= '0';
        s_k <= '0';
        wait for 10ns;
        s_j <= '0';
        s_k <= '0';
        wait for 10ns;
        s_j <= '1';
        s_k <= '0';
        wait for 15ns;
        s_j <= '0';
        s_k <= '0';
        wait for 15ns;
        s_j <= '0';
        s_k <= '1';
        wait for 5ns;
        s_j <= '0';
        s_k <= '0';
        wait for 15ns;
        s_j <= '1';
        s_k <= '1';
        wait for 20ns;
        s_j <= '0';
        s_k <= '0';
        wait for 10ns;
        s_j <= '0';
        s_k <= '0';
        wait for 10ns;
        s_j <= '1';
        s_k <= '0';
        wait for 15ns;
        s_j <= '0';
        s_k <= '0';
        wait for 15ns;
        s_j <= '0';
        s_k <= '1';
        wait for 5ns;
        s_j <= '0';
        s_k <= '0';
        wait for 15ns;
        s_j <= '1';
        s_k <= '1';
        wait for 20ns;
        s_j <= '0';
        s_k <= '0';
        wait for 10ns;
        s_j <= '0';
        s_k <= '0';
        wait for 10ns;
        s_j <= '1';
        s_k <= '0';
        wait for 15ns;
        s_j <= '0';
        s_k <= '0';
```

```
        wait for 15ns;
        s_j <= '0';
        s_k <= '1';
        wait for 5ns;
        s_j <= '0';
        s_k <= '0';
        wait for 15ns;
        s_j <= '1';
        s_k <= '1';
        wait for 20ns;
        s_j <= '0';
        s_k <= '0';
        wait for 10ns;
        s_j <= '0';
        s_k <= '0';
        wait for 10ns;
        s_j <= '1';
        s_k <= '0';
        wait for 15ns;
        s_j <= '0';
        s_k <= '0';
        wait for 15ns;
        s_j <= '0';
        s_k <= '1';
        wait for 5ns;
        s_j <= '0';
        s_k <= '0';
        wait for 15ns;
        s_j <= '1';
        s_k <= '1';
        wait for 20ns;
        s_j <= '0';
        s_k <= '0';
        wait for 10ns;
        s_j <= '0';
        s_k <= '0';
        wait for 10ns;
        s_j <= '1';
        s_k <= '0';
        wait for 15ns;
        s_j <= '0';
        s_k <= '0';
        wait for 15ns;
        s_j <= '0';
        s_k <= '1';
        wait for 5ns;
        s_j <= '0';
        s_k <= '0';
        wait for 15ns;
        s_j <= '1';
        s_k <= '1';
        wait for 20ns;
        s_j <= '0';
        s_k <= '0';
```

```
            wait for 10ns;

        report "Stimulus process finished" severity note;
        wait;
    end process p_stimulus;
```

3.8. Súbor tb_p_t_ff_rst

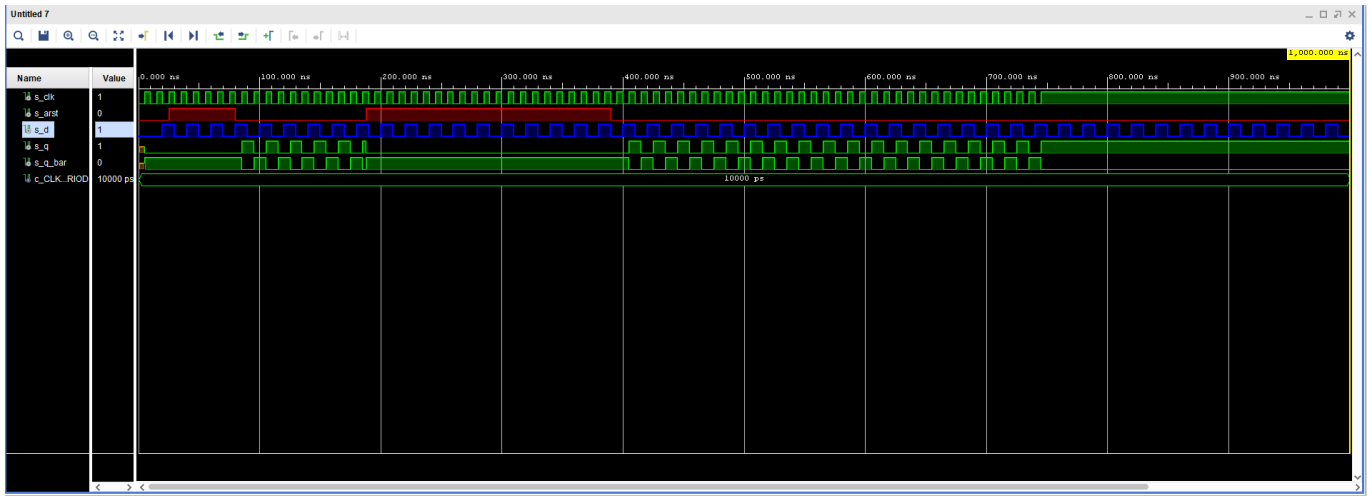
```
    p_reset : process
    begin
        s_rst <= '0';
        wait for 25 ns;
        s_rst <= '1';
        wait for 55 ns;
        -- Reset activated
        s_rst <= '0';
        wait for 660 ns;
        s_rst <= '1';
        wait;
    end process p_reset;

     p_stimulus : process
    begin
        report "Stimulus process started" severity note;

            s_t <= '0';

            assert(s_q ='0')
            report "" severity error;


            s_t <= '0';
            wait for 10ns;
            s_t <= '1';
            wait for 15ns;
            s_t <= '0';
            wait for 15ns;
            s_t <= '1';
            wait for 5ns;
            s_t <= '0';
            wait for 15ns;
            s_t <= '1';
            wait for 20ns;
            s_t <= '0';
            wait for 10ns;

            s_t <= '0';
            wait for 10ns;
            s_t <= '1';
            wait for 15ns;
            s_t <= '0';
```

```
            wait for 15ns;
            s_t <= '1';
            wait for 5ns;
            s_t <= '0';
            wait for 15ns;
            s_t <= '1';
            wait for 20ns;
            s_t <= '0';
            wait for 10ns;

            s_t <= '0';
            wait for 10ns;
            s_t <= '1';
            wait for 15ns;
            s_t <= '0';
            wait for 15ns;
            s_t <= '1';
            wait for 5ns;
            s_t <= '0';
            wait for 15ns;
            s_t <= '1';
            wait for 20ns;
            s_t <= '0';
            wait for 10ns;

            s_t <= '0';
            wait for 10ns;
            s_t <= '1';
            wait for 15ns;
            s_t <= '0';
            wait for 15ns;
            s_t <= '1';
            wait for 5ns;
            s_t <= '0';
            wait for 15ns;
            s_t <= '1';
            wait for 20ns;
            s_t <= '0';
            wait for 10ns;

            s_t <= '0';
            wait for 10ns;
            s_t <= '1';
            wait for 15ns;
            s_t <= '0';
            wait for 15ns;
            s_t <= '1';
            wait for 5ns;
            s_t <= '0';
            wait for 15ns;
            s_t <= '1';
            wait for 20ns;
            s_t <= '0';
            wait for 10ns;
```

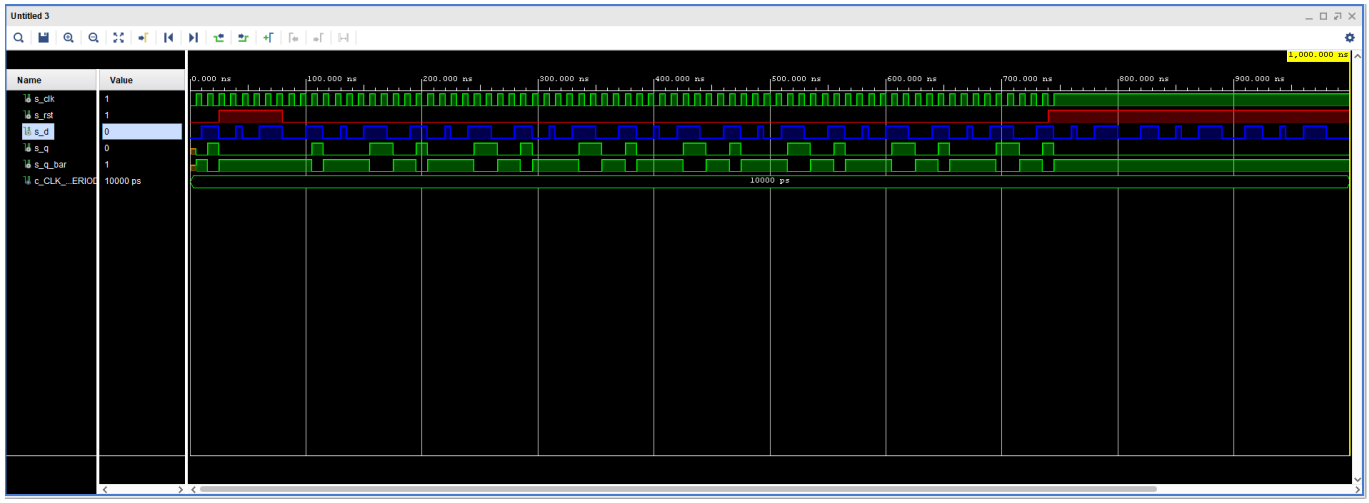
```
            s_t <= '0';
            wait for 10ns;
            s_t <= '1';
            wait for 15ns;
            s_t <= '0';
            wait for 15ns;
            s_t <= '1';
            wait for 5ns;
            s_t <= '0';
            wait for 15ns;
            s_t <= '1';
            wait for 20ns;
            s_t <= '0';
            wait for 10ns;

            s_t <= '0';
            wait for 10ns;
            s_t <= '1';
            wait for 15ns;
            s_t <= '0';
            wait for 15ns;
            s_t <= '1';
            wait for 5ns;
            s_t <= '0';
            wait for 15ns;
            s_t <= '1';
            wait for 20ns;
            s_t <= '0';
            wait for 10ns;

            s_t <= '0';
            wait for 10ns;
            s_t <= '1';
            wait for 15ns;
            s_t <= '0';
            wait for 15ns;
            s_t <= '1';
            wait for 5ns;
            s_t <= '0';
            wait for 15ns;
            s_t <= '1';
            wait for 20ns;
            s_t <= '0';
            wait for 10ns;

            s_t <= '0';
            wait for 10ns;
            s_t <= '1';
            wait for 15ns;
            s_t <= '0';
            wait for 15ns;
            s_t <= '1';
            wait for 5ns;
```

```
            s_t <= '0';
            wait for 15ns;
            s_t <= '1';
            wait for 20ns;
            s_t <= '0';
            wait for 10ns;

            s_t <= '0';
            wait for 10ns;
            s_t <= '1';
            wait for 15ns;
            s_t <= '0';
            wait for 15ns;
            s_t <= '1';
            wait for 5ns;
            s_t <= '0';
            wait for 15ns;
            s_t <= '1';
            wait for 20ns;
            s_t <= '0';
            wait for 10ns;

            s_t <= '0';
            wait for 10ns;
            s_t <= '1';
            wait for 15ns;
            s_t <= '0';
            wait for 15ns;
            s_t <= '1';
            wait for 5ns;
            s_t <= '0';
            wait for 15ns;
            s_t <= '1';
            wait for 20ns;
            s_t <= '0';
            wait for 10ns;

        report "Stimulus process finished" severity note;
        wait;
    end process p_stimulus;
```

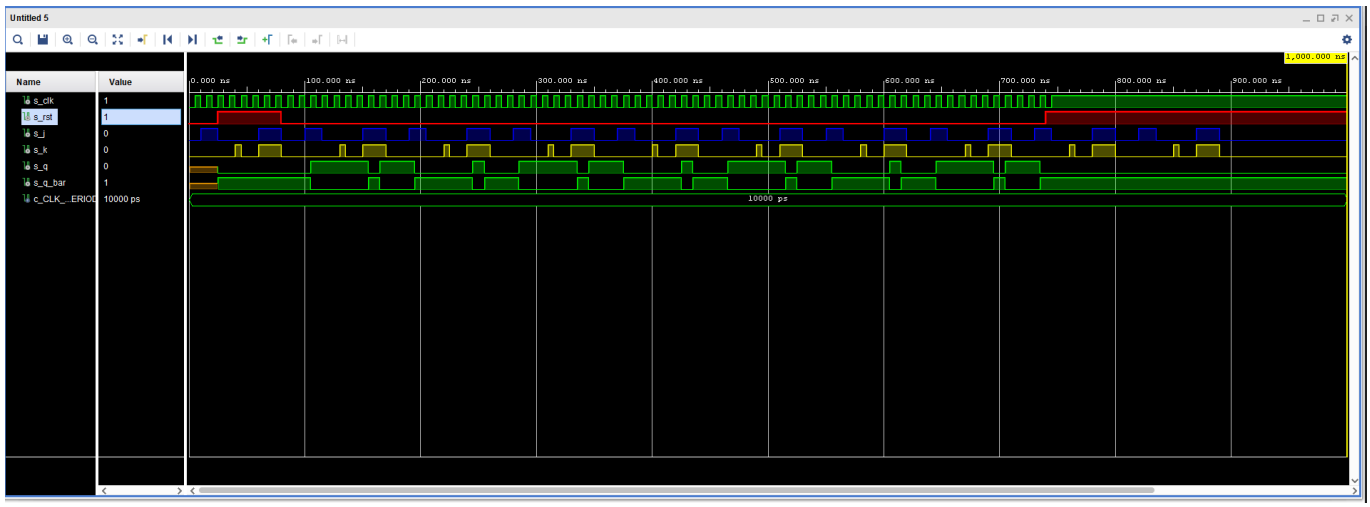
3.9. Vystup symulácie tb_p_d_ff_arst



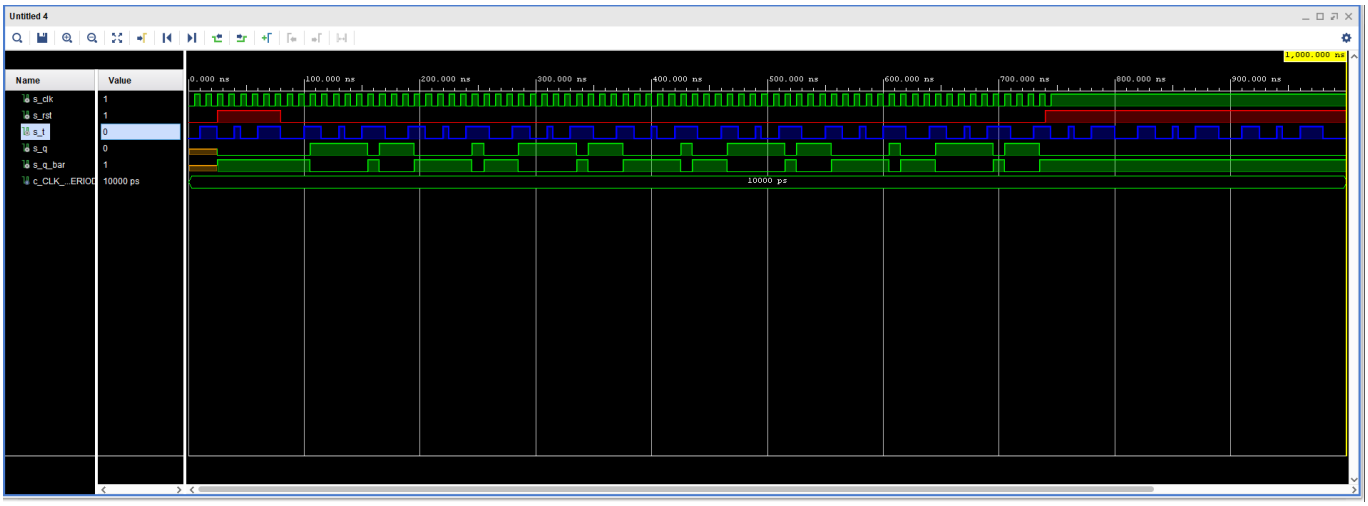
3.10. Vystup symulácie tb_p_d_ff_rst



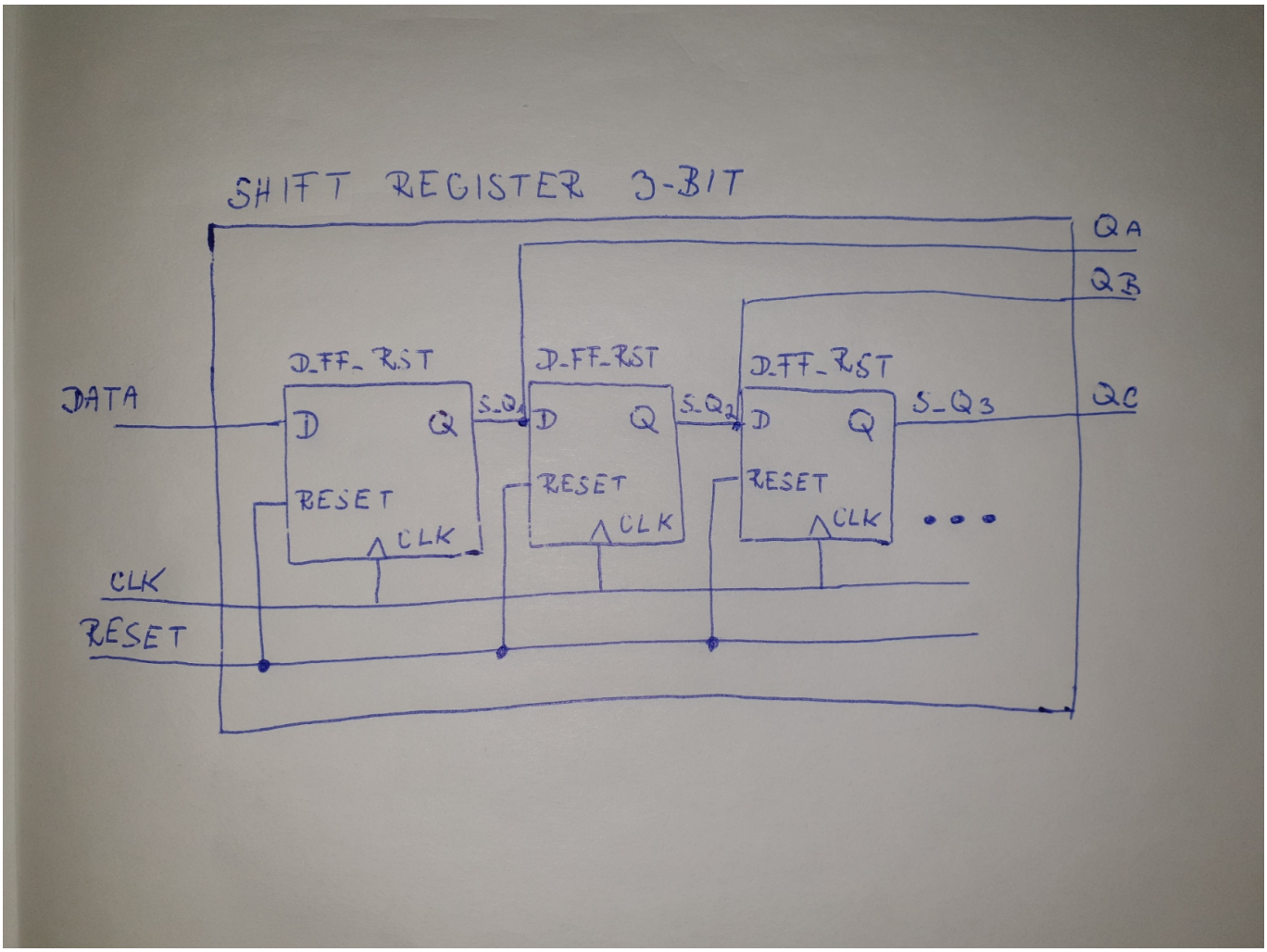
3.11. Vystup symulácie tb_p_jk_ff_rst



3.12. Vystup symulácie tb_p_t_ff_rst



4. Posuvný register pre 3-bit



- Naznačenými bodkami je možné pokračovať do požadovaného počtu bitov