

**We are generating a 64-to-1 multiplexer hierarchically in Verilog. We have generated 2-to-1 multiplexer, 4-to-1 multiplexer, 8-to-1 multiplexer, 16-to-1 multiplexer, 32-to-1 multiplexer defined as follows:**

```
module mux2_1(in1, in2, select, out);  
input in1, in2;  
input select;  
output out;
```

```
    assign out = select ? in2 : in1;
```

```
endmodule
```

```
module mux4_1(in, select, out);  
input [3:0] in;  
input [1:0] select;  
output out;
```

```
    wire mux_out1, mux_out2;  
  
    // First level of 2-to-1 multiplexers  
    mux2_1 mux1 (.in1(in[0]), .in2(in[1]), .select(select[0]), .out(mux_out1));  
    mux2_1 mux2 (.in1(in[2]), .in2(in[3]), .select(select[0]), .out(mux_out2));  
  
    // Second level of 2-to-1 multiplexer  
    mux2_1 mux3 (.in1(mux_out1), .in2(mux_out2), .select(select[1]), .out(out));
```

```
endmodule
```

```
module mux8_1(in, select, out);  
input [7:0] in;  
input [2:0] select;  
output out;
```

```
    wire mux_out1, mux_out2;  
  
    // First level of 4-to-1 multiplexers  
    mux4_1 mux1 (.in(in[3:0]), .select(select[1:0]), .out(mux_out1));
```

```

mux4_1 mux2 (.in(in[7:4]), .select(select[1:0]), .out(mux_out2));

// Second level of 2-to-1 multiplexer
mux2_1 mux3 (.in1(mux_out1), .in2(mux_out2), .select(select[2]), .out(out));

```

endmodule

```

module mux16_1(in, select, out);
input [15:0] in;
input [3:0] select;
output out;

```

```

wire mux_out1, mux_out2;

// First level of 8-to-1 multiplexers
mux8_1 mux1 (.in(in[7:0]), .select(select[2:0]), .out(mux_out1));
mux8_1 mux2 (.in(in[15:8]), .select(select[2:0]), .out(mux_out2));

// Second level of 2-to-1 multiplexer
mux2_1 mux3 (.in1(mux_out1), .in2(mux_out2), .select(select[3]), .out(out));

```

endmodule

```

module mux32_1(in, select, out);
input [31:0] in;
input [4:0] select;
output out;

```

```

wire mux_out1, mux_out2;

// First level of 16-to-1 multiplexers
mux16_1 mux1 (.in(in[15:0]), .select(select[3:0]), .out(mux_out1));
mux16_1 mux2 (.in(in[31:16]), .select(select[3:0]), .out(mux_out2));

// Second level of 2-to-1 multiplexer
mux2_1 mux3 (.in1(mux_out1), .in2(mux_out2), .select(select[4]), .out(out));

```

endmodule

Please include the previous module(s) in your response and use them to hierarchically generate a 64-to-1 multiplexer defined as:

```

module mux64_1(in[63:0], select, out);
//Insert code here
endmodule

```

```

module mux2_1(in1, in2, select, out);
input in1, in2;
input select;
output out;

```

```

        assign out = select ? in2 : in1;

endmodule

module mux4_1(in, select, out);
    input [3:0] in;
    input [1:0] select;
    output out;

    wire mux_out1, mux_out2;

    // First level of 2-to-1 multiplexers
    mux2_1 mux1 (.in1(in[0]), .in2(in[1]), .select(select[0]), .out(mux_out1));
    mux2_1 mux2 (.in1(in[2]), .in2(in[3]), .select(select[0]), .out(mux_out2));

    // Second level of 2-to-1 multiplexer
    mux2_1 mux3 (.in1(mux_out1), .in2(mux_out2), .select(select[1]), .out(out));

endmodule

module mux8_1(in, select, out);
    input [7:0] in;
    input [2:0] select;
    output out;

    wire mux_out1, mux_out2;

    // First level of 4-to-1 multiplexers
    mux4_1 mux1 (.in(in[3:0]), .select(select[1:0]), .out(mux_out1));
    mux4_1 mux2 (.in(in[7:4]), .select(select[1:0]), .out(mux_out2));

    // Second level of 2-to-1 multiplexer
    mux2_1 mux3 (.in1(mux_out1), .in2(mux_out2), .select(select[2]), .out(out));

endmodule

module mux16_1(in, select, out);
    input [15:0] in;
    input [3:0] select;
    output out;

    wire mux_out1, mux_out2;

    // First level of 8-to-1 multiplexers
    mux8_1 mux1 (.in(in[7:0]), .select(select[2:0]), .out(mux_out1));
    mux8_1 mux2 (.in(in[15:8]), .select(select[2:0]), .out(mux_out2));

    // Second level of 2-to-1 multiplexer
    mux2_1 mux3 (.in1(mux_out1), .in2(mux_out2), .select(select[3]), .out(out));

endmodule

module mux32_1(in, select, out);
    input [31:0] in;
    input [4:0] select;
    output out;

```

```

    wire mux_out1, mux_out2;

    // First level of 16-to-1 multiplexers
    mux16_1 mux1 (.in(in[15:0]), .select(select[3:0]), .out(mux_out1));
    mux16_1 mux2 (.in(in[31:16]), .select(select[3:0]), .out(mux_out2));

    // Second level of 2-to-1 multiplexer
    mux2_1 mux3 (.in1(mux_out1), .in2(mux_out2), .select(select[4]), .out(out));

endmodule

module mux64_1(in, select, out);
    input [63:0] in;
    input [5:0] select;
    output out;

    wire mux_out1, mux_out2;

    // First level of 32-to-1 multiplexers
    mux32_1 mux1 (.in(in[31:0]), .select(select[4:0]), .out(mux_out1));
    mux32_1 mux2 (.in(in[63:32]), .select(select[4:0]), .out(mux_out2));

    // Second level of 2-to-1 multiplexer
    mux2_1 mux3 (.in1(mux_out1), .in2(mux_out2), .select(select[5]), .out(out));

endmodule

```