Prompt for 3-bit adder:

You are an expert in logic design. Provide CNF equations in the format NAME = CNF_EXPRESSION, using ∧ for AND, ∨ for OR, and ! for NOT.

Give me the CNF (conjunctive normal form) equation for a 3-bit full adder. Assume inputs A0, B0, A1, B1,A2,B2, Cin and outputs S0, S1,S2, Cout. Just return the equations for S0, S1, S2, Cout in the specified format.

Inputs: A0, A1, A2, B0, B1, B2, Cin (7 inputs)

Outputs: S0, S1, S2, Cout (4 outputs)

LLM	No. of iterations to get correct CNF (including changing prompts)	Correct CNF
GPT-4o-mini	3 prompt changes, 5 reruns	Yes
Gemini 2.5 pro	3 reruns (same prompt)	Yes
Claude Sonnet 4	2 reruns (same prompt)	Yes

GPT-4o-mini required prompt modifications to achieve correct format

Gemini and Claude maintained consistent prompt interpretation

All models eventually produced functionally correct CNF

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module adder_3_bit(

   A0, A1, A2, B0, B1, B2, Cin, Cout, S0, S1, S2

);

    input  A0, A1, A2, B0, B1, B2, Cin;

  output Cout, S0, S1, S2;

  wire   CONST0, CONST1, n_not_A0, n_not_A1, n_not_A2, n_not_B0, n_not_B1, n_not_B2, n_not_Cin, p_Cout_0, p_Cout_1, p_Cout_10, p_Cout_11, p_Cout_12, p_Cout_13, p_Cout_14, p_Cout_15, p_Cout_16,
p_Cout_17, p_Cout_18, p_Cout_19, p_Cout_2, p_Cout_20, p_Cout_21, p_Cout_22, p_Cout_23, p_Cout_24, p_Cout_25, p_Cout_26, p_Cout_27, p_Cout_28, p_Cout_29, p_Cout_3, p_Cout_30, p_Cout_31, p_Cout_32,
p_Cout_33, p_Cout_34, p_Cout_35, p_Cout_36, p_Cout_37, p_Cout_38, p_Cout_39, p_Cout_4, p_Cout_40, p_Cout_41, p_Cout_42, p_Cout_43, p_Cout_44, p_Cout_45, p_Cout_46, p_Cout_47, p_Cout_48, p_Cout_49,
p_Cout_5, p_Cout_50, p_Cout_51, p_Cout_52, p_Cout_53, p_Cout_54, p_Cout_55, p_Cout_56, p_Cout_57, p_Cout_58, p_Cout_59, p_Cout_6, p_Cout_60, p_Cout_61, p_Cout_62, p_Cout_63, p_Cout_7, p_Cout_8,
p_Cout_9, p_S0_0, p_S0_1, p_S0_10, p_S0_11, p_S0_12, p_S0_13, p_S0_14, p_S0_15, p_S0_16, p_S0_17, p_S0_18, p_S0_19, p_S0_2, p_S0_20, p_S0_21, p_S0_22, p_S0_23, p_S0_24, p_S0_25, p_S0_26, p_S0_27,
p_S0_28, p_S0_29, p_S0_3, p_S0_30, p_S0_31, p_S0_32, p_S0_33, p_S0_34, p_S0_35, p_S0_36, p_S0_37, p_S0_38, p_S0_39, p_S0_4, p_S0_40, p_S0_41, p_S0_42, p_S0_43, p_S0_44, p_S0_45, p_S0_46, p_S0_47,
p_S0_48, p_S0_49, p_S0_5, p_S0_50, p_S0_51, p_S0_52, p_S0_53, p_S0_54, p_S0_55, p_S0_56, p_S0_57, p_S0_58, p_S0_59, p_S0_6, p_S0_60, p_S0_61, p_S0_62, p_S0_63, p_S0_7, p_S0_8, p_S0_9, p_S1_0, p_S1_1,
p_S1_10, p_S1_11, p_S1_12, p_S1_13, p_S1_14, p_S1_15, p_S1_16, p_S1_17, p_S1_18, p_S1_19, p_S1_2, p_S1_20, p_S1_21, p_S1_22, p_S1_23, p_S1_24, p_S1_25, p_S1_26, p_S1_27, p_S1_28, p_S1_29, p_S1_3,
p_S1_30, p_S1_31, p_S1_32, p_S1_33, p_S1_34, p_S1_35, p_S1_36, p_S1_37, p_S1_38, p_S1_39, p_S1_4, p_S1_40, p_S1_41, p_S1_42, p_S1_43, p_S1_44, p_S1_45, p_S1_46, p_S1_47, p_S1_48, p_S1_49, p_S1_5,
p_S1_50, p_S1_51, p_S1_52, p_S1_53, p_S1_54, p_S1_55, p_S1_56, p_S1_57, p_S1_58, p_S1_59, p_S1_6, p_S1_60, p_S1_61, p_S1_62, p_S1_63, p_S1_7, p_S1_8, p_S1_9, p_S2_0, p_S2_1, p_S2_10, p_S2_11, p_S2_12,
p_S2_13, p_S2_14, p_S2_15, p_S2_16, p_S2_17, p_S2_18, p_S2_19, p_S2_2, p_S2_20, p_S2_21, p_S2_22, p_S2_23, p_S2_24, p_S2_25, p_S2_26, p_S2_27, p_S2_28, p_S2_29, p_S2_3, p_S2_30, p_S2_31, p_S2_32,
p_S2_33, p_S2_34, p_S2_35, p_S2_36, p_S2_37, p_S2_38, p_S2_39, p_S2_4, p_S2_40, p_S2_41, p_S2_42, p_S2_43, p_S2_44, p_S2_45, p_S2_46, p_S2_47, p_S2_48, p_S2_49, p_S2_5, p_S2_50, p_S2_51, p_S2_52,
p_S2_53, p_S2_54, p_S2_55, p_S2_56, p_S2_57, p_S2_58, p_S2_59, p_S2_6, p_S2_60, p_S2_61, p_S2_62, p_S2_63, p_S2_7, p_S2_8, p_S2_9;



  assign CONST0 = (A0 & n_not_A0);

  assign CONST1 = (A0 | n_not_A0);

  assign Cout = (p_Cout_0 | p_Cout_1 | p_Cout_2 | p_Cout_3 | p_Cout_4 | p_Cout_5 | p_Cout_6 | p_Cout_7 | p_Cout_8 | p_Cout_9 | p_Cout_10 | p_Cout_11 | p_Cout_12 | p_Cout_13 | p_Cout_14 | p_Cout_15 | p_Cout_16 |
p_Cout_17 | p_Cout_18 | p_Cout_19 | p_Cout_20 | p_Cout_21 | p_Cout_22 | p_Cout_23 | p_Cout_24 | p_Cout_25 | p_Cout_26 | p_Cout_27 | p_Cout_28 | p_Cout_29 | p_Cout_30 | p_Cout_31 | p_Cout_32 | p_Cout_33 |
p_Cout_34 | p_Cout_35 | p_Cout_36 | p_Cout_37 | p_Cout_38 | p_Cout_39 | p_Cout_40 | p_Cout_41 | p_Cout_42 | p_Cout_43 | p_Cout_44 | p_Cout_45 | p_Cout_46 | p_Cout_47 | p_Cout_48 | p_Cout_49 | p_Cout_50 |
p_Cout_51 | p_Cout_52 | p_Cout_53 | p_Cout_54 | p_Cout_55 | p_Cout_56 | p_Cout_57 | p_Cout_58 | p_Cout_59 | p_Cout_60 | p_Cout_61 | p_Cout_62 | p_Cout_63);
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  assign S0 = (p_S0_0 | p_S0_1 | p_S0_2 | p_S0_3 | p_S0_4 | p_S0_5 | p_S0_6 | p_S0_7 | p_S0_8 | p_S0_9 | p_S0_10 | p_S0_11 | p_S0_12 | p_S0_13 | p_S0_14 | p_S0_15 | p_S0_16 | p_S0_17 | p_S0_18 | p_S0_19 | p_S0_20 |
p_S0_21 | p_S0_22 | p_S0_23 | p_S0_24 | p_S0_25 | p_S0_26 | p_S0_27 | p_S0_28 | p_S0_29 | p_S0_30 | p_S0_31 | p_S0_32 | p_S0_33 | p_S0_34 | p_S0_35 | p_S0_36 | p_S0_37 | p_S0_38 | p_S0_39 | p_S0_40 | p_S0_41 |
p_S0_42 | p_S0_43 | p_S0_44 | p_S0_45 | p_S0_46 | p_S0_47 | p_S0_48 | p_S0_49 | p_S0_50 | p_S0_51 | p_S0_52 | p_S0_53 | p_S0_54 | p_S0_55 | p_S0_56 | p_S0_57 | p_S0_58 | p_S0_59 | p_S0_60 | p_S0_61 | p_S0_62 |
p_S0_63);

  assign S1 = (p_S1_0 | p_S1_1 | p_S1_2 | p_S1_3 | p_S1_4 | p_S1_5 | p_S1_6 | p_S1_7 | p_S1_8 | p_S1_9 | p_S1_10 | p_S1_11 | p_S1_12 | p_S1_13 | p_S1_14 | p_S1_15 | p_S1_16 | p_S1_17 | p_S1_18 | p_S1_19 | p_S1_20 |
p_S1_21 | p_S1_22 | p_S1_23 | p_S1_24 | p_S1_25 | p_S1_26 | p_S1_27 | p_S1_28 | p_S1_29 | p_S1_30 | p_S1_31 | p_S1_32 | p_S1_33 | p_S1_34 | p_S1_35 | p_S1_36 | p_S1_37 | p_S1_38 | p_S1_39 | p_S1_40 | p_S1_41 |
p_S1_42 | p_S1_43 | p_S1_44 | p_S1_45 | p_S1_46 | p_S1_47 | p_S1_48 | p_S1_49 | p_S1_50 | p_S1_51 | p_S1_52 | p_S1_53 | p_S1_54 | p_S1_55 | p_S1_56 | p_S1_57 | p_S1_58 | p_S1_59 | p_S1_60 | p_S1_61 | p_S1_62 |
p_S1_63);

  assign S2 = (p_S2_0 | p_S2_1 | p_S2_2 | p_S2_3 | p_S2_4 | p_S2_5 | p_S2_6 | p_S2_7 | p_S2_8 | p_S2_9 | p_S2_10 | p_S2_11 | p_S2_12 | p_S2_13 | p_S2_14 | p_S2_15 | p_S2_16 | p_S2_17 | p_S2_18 | p_S2_19 | p_S2_20 |
p_S2_21 | p_S2_22 | p_S2_23 | p_S2_24 | p_S2_25 | p_S2_26 | p_S2_27 | p_S2_28 | p_S2_29 | p_S2_30 | p_S2_31 | p_S2_32 | p_S2_33 | p_S2_34 | p_S2_35 | p_S2_36 | p_S2_37 | p_S2_38 | p_S2_39 | p_S2_40 | p_S2_41 |
p_S2_42 | p_S2_43 | p_S2_44 | p_S2_45 | p_S2_46 | p_S2_47 | p_S2_48 | p_S2_49 | p_S2_50 | p_S2_51 | p_S2_52 | p_S2_53 | p_S2_54 | p_S2_55 | p_S2_56 | p_S2_57 | p_S2_58 | p_S2_59 | p_S2_60 | p_S2_61 | p_S2_62 |
p_S2_63);

  assign n_not_A0 = ~(A0);

  assign n_not_A1 = ~(A1);

  assign n_not_A2 = ~(A2);

  assign n_not_B0 = ~(B0);

  assign n_not_B1 = ~(B1);

  assign n_not_B2 = ~(B2);

  assign n_not_Cin = ~(Cin);

  assign p_Cout_0 = (n_not_A0 & n_not_B0 & n_not_A1 & n_not_B1 & n_not_A2 & n_not_B2 & n_not_Cin);

  assign p_Cout_1 = (n_not_A0 & n_not_B0 & n_not_A1 & n_not_B1 & n_not_A2 & B2 & n_not_Cin);

  assign p_Cout_10 = (n_not_A0 & n_not_B0 & A1 & n_not_B1 & A2 & n_not_B2 & n_not_Cin);

  assign p_Cout_11 = (n_not_A0 & n_not_B0 & A1 & n_not_B1 & A2 & B2 & n_not_Cin);

  assign p_Cout_12 = (n_not_A0 & n_not_B0 & A1 & B1 & n_not_A2 & n_not_B2 & n_not_Cin);

  assign p_Cout_13 = (n_not_A0 & n_not_B0 & A1 & B1 & n_not_A2 & B2 & n_not_Cin);

  assign p_Cout_14 = (n_not_A0 & n_not_B0 & A1 & B1 & A2 & n_not_B2 & n_not_Cin);

  assign p_Cout_15 = (n_not_A0 & n_not_B0 & A1 & B1 & A2 & B2 & n_not_Cin);

  assign p_Cout_16 = (n_not_A0 & B0 & n_not_A1 & n_not_B1 & n_not_A2 & n_not_B2 & Cin);

  assign p_Cout_17 = (n_not_A0 & B0 & n_not_A1 & n_not_B1 & n_not_A2 & B2 & Cin);

  assign p_Cout_18 = (n_not_A0 & B0 & n_not_A1 & n_not_B1 & A2 & n_not_B2 & Cin);

  assign p_Cout_19 = (n_not_A0 & B0 & n_not_A1 & n_not_B1 & A2 & B2 & Cin);

  assign p_Cout_2 = (n_not_A0 & n_not_B0 & n_not_A1 & n_not_B1 & A2 & n_not_B2 & n_not_Cin);

  assign p_Cout_20 = (n_not_A0 & B0 & n_not_A1 & B1 & n_not_A2 & n_not_B2 & Cin);

  assign p_Cout_21 = (n_not_A0 & B0 & n_not_A1 & B1 & n_not_A2 & B2 & Cin);

  assign p_Cout_22 = (n_not_A0 & B0 & n_not_A1 & B1 & A2 & n_not_B2 & Cin);

  assign p_Cout_23 = (n_not_A0 & B0 & n_not_A1 & B1 & A2 & B2 & Cin);

  assign p_Cout_24 = (n_not_A0 & B0 & A1 & n_not_B1 & n_not_A2 & n_not_B2 & Cin);

  assign p_Cout_25 = (n_not_A0 & B0 & A1 & n_not_B1 & n_not_A2 & B2 & Cin);

  assign p_Cout_26 = (n_not_A0 & B0 & A1 & n_not_B1 & A2 & n_not_B2 & Cin);

  assign p_Cout_27 = (n_not_A0 & B0 & A1 & n_not_B1 & A2 & B2 & Cin);

  assign p_Cout_28 = (n_not_A0 & B0 & A1 & B1 & n_not_A2 & n_not_B2 & Cin);

  assign p_Cout_29 = (n_not_A0 & B0 & A1 & B1 & n_not_A2 & B2 & Cin);

  assign p_Cout_3 = (n_not_A0 & n_not_B0 & n_not_A1 & n_not_B1 & A2 & B2 & n_not_Cin);

  assign p_Cout_30 = (n_not_A0 & B0 & A1 & B1 & A2 & n_not_B2 & Cin);

  assign p_Cout_31 = (n_not_A0 & B0 & A1 & B1 & A2 & B2 & Cin);

  assign p_Cout_32 = (A0 & n_not_B0 & n_not_A1 & n_not_B1 & n_not_A2 & n_not_B2 & Cin);

  assign p_Cout_33 = (A0 & n_not_B0 & n_not_A1 & n_not_B1 & n_not_A2 & B2 & Cin);

  assign p_Cout_34 = (A0 & n_not_B0 & n_not_A1 & n_not_B1 & A2 & n_not_B2 & Cin);

  assign p_Cout_35 = (A0 & n_not_B0 & n_not_A1 & n_not_B1 & A2 & B2 & Cin);

  assign p_Cout_36 = (A0 & n_not_B0 & n_not_A1 & B1 & n_not_A2 & n_not_B2 & Cin);

  assign p_Cout_37 = (A0 & n_not_B0 & n_not_A1 & B1 & n_not_A2 & B2 & Cin);

  assign p_Cout_38 = (A0 & n_not_B0 & n_not_A1 & B1 & A2 & n_not_B2 & Cin);

  assign p_Cout_39 = (A0 & n_not_B0 & n_not_A1 & B1 & A2 & B2 & Cin);

  assign p_Cout_4 = (n_not_A0 & n_not_B0 & n_not_A1 & B1 & n_not_A2 & n_not_B2 & n_not_Cin);
  assign p_Cout_40 = (A0 & n_not_B0 & A1 & n_not_B1 & n_not_A2 & n_not_B2 & Cin);

  assign p_Cout_41 = (A0 & n_not_B0 & A1 & n_not_B1 & n_not_A2 & B2 & Cin);

  assign p_Cout_42 = (A0 & n_not_B0 & A1 & n_not_B1 & A2 & n_not_B2 & Cin);

  assign p_Cout_43 = (A0 & n_not_B0 & A1 & n_not_B1 & A2 & B2 & Cin);

  assign p_Cout_44 = (A0 & n_not_B0 & A1 & B1 & n_not_A2 & n_not_B2 & Cin);

  assign p_Cout_45 = (A0 & n_not_B0 & A1 & B1 & n_not_A2 & B2 & Cin);

  assign p_Cout_46 = (A0 & n_not_B0 & A1 & B1 & A2 & n_not_B2 & Cin);

  assign p_Cout_47 = (A0 & n_not_B0 & A1 & B1 & A2 & B2 & Cin);

  assign p_Cout_48 = (A0 & B0 & n_not_A1 & n_not_B1 & n_not_A2 & n_not_B2 & Cin);

  assign p_Cout_49 = (A0 & B0 & n_not_A1 & n_not_B1 & n_not_A2 & B2 & Cin);

  assign p_Cout_5 = (n_not_A0 & n_not_B0 & n_not_A1 & B1 & n_not_A2 & B2 & n_not_Cin);

  assign p_Cout_50 = (A0 & B0 & n_not_A1 & n_not_B1 & A2 & n_not_B2 & Cin);

  assign p_Cout_51 = (A0 & B0 & n_not_A1 & n_not_B1 & A2 & B2 & Cin);

  assign p_Cout_52 = (A0 & B0 & n_not_A1 & B1 & n_not_A2 & n_not_B2 & Cin);

  assign p_Cout_53 = (A0 & B0 & n_not_A1 & B1 & n_not_A2 & B2 & Cin);

  assign p_Cout_54 = (A0 & B0 & n_not_A1 & B1 & A2 & n_not_B2 & Cin);

  assign p_Cout_55 = (A0 & B0 & n_not_A1 & B1 & A2 & B2 & Cin);

  assign p_Cout_56 = (A0 & B0 & A1 & n_not_B1 & n_not_A2 & n_not_B2 & Cin);

  assign p_Cout_57 = (A0 & B0 & A1 & n_not_B1 & n_not_A2 & B2 & Cin);

  assign p_Cout_58 = (A0 & B0 & A1 & n_not_B1 & A2 & n_not_B2 & Cin);

  assign p_Cout_59 = (A0 & B0 & A1 & n_not_B1 & A2 & B2 & Cin);

  assign p_Cout_6 = (n_not_A0 & n_not_B0 & n_not_A1 & B1 & A2 & n_not_B2 & n_not_Cin);

  assign p_Cout_60 = (A0 & B0 & A1 & B1 & n_not_A2 & n_not_B2 & Cin);

  assign p_Cout_61 = (A0 & B0 & A1 & B1 & n_not_A2 & B2 & Cin);

  assign p_Cout_62 = (A0 & B0 & A1 & B1 & A2 & n_not_B2 & Cin);

  assign p_Cout_63 = (A0 & B0 & A1 & B1 & A2 & B2 & Cin);

  assign p_Cout_7 = (n_not_A0 & n_not_B0 & n_not_A1 & B1 & A2 & B2 & n_not_Cin);

  assign p_Cout_8 = (n_not_A0 & n_not_B0 & A1 & n_not_B1 & n_not_A2 & n_not_B2 & n_not_Cin);

  assign p_Cout_9 = (n_not_A0 & n_not_B0 & A1 & n_not_B1 & n_not_A2 & B2 & n_not_Cin);

  assign p_S0_0 = (n_not_A0 & n_not_B0 & n_not_A1 & n_not_B1 & n_not_A2 & n_not_B2 & n_not_Cin);

  assign p_S0_1 = (n_not_A0 & n_not_B0 & n_not_A1 & n_not_B1 & n_not_A2 & B2 & n_not_Cin);

  assign p_S0_10 = (n_not_A0 & n_not_B0 & A1 & n_not_B1 & A2 & n_not_B2 & n_not_Cin);

  assign p_S0_11 = (n_not_A0 & n_not_B0 & A1 & n_not_B1 & A2 & B2 & n_not_Cin);

  assign p_S0_12 = (n_not_A0 & n_not_B0 & A1 & B1 & n_not_A2 & n_not_B2 & n_not_Cin);

  assign p_S0_13 = (n_not_A0 & n_not_B0 & A1 & B1 & n_not_A2 & B2 & n_not_Cin);

  assign p_S0_14 = (n_not_A0 & n_not_B0 & A1 & B1 & A2 & n_not_B2 & n_not_Cin);

  assign p_S0_15 = (n_not_A0 & n_not_B0 & A1 & B1 & A2 & B2 & n_not_Cin);

  assign p_S0_16 = (n_not_A0 & B0 & n_not_A1 & n_not_B1 & n_not_A2 & n_not_B2 & Cin);

  assign p_S0_17 = (n_not_A0 & B0 & n_not_A1 & n_not_B1 & n_not_A2 & B2 & Cin);

  assign p_S0_18 = (n_not_A0 & B0 & n_not_A1 & n_not_B1 & A2 & n_not_B2 & Cin);

  assign p_S0_19 = (n_not_A0 & B0 & n_not_A1 & n_not_B1 & A2 & B2 & Cin);

  assign p_S0_2 = (n_not_A0 & n_not_B0 & n_not_A1 & n_not_B1 & A2 & n_not_B2 & n_not_Cin);

  assign p_S0_20 = (n_not_A0 & B0 & n_not_A1 & B1 & n_not_A2 & n_not_B2 & Cin);

  assign p_S0_21 = (n_not_A0 & B0 & n_not_A1 & B1 & n_not_A2 & B2 & Cin);

  assign p_S0_22 = (n_not_A0 & B0 & n_not_A1 & B1 & A2 & n_not_B2 & Cin);

  assign p_S0_23 = (n_not_A0 & B0 & n_not_A1 & B1 & A2 & B2 & Cin);

  assign p_S0_24 = (n_not_A0 & B0 & A1 & n_not_B1 & n_not_A2 & n_not_B2 & Cin);

  assign p_S0_25 = (n_not_A0 & B0 & A1 & n_not_B1 & n_not_A2 & B2 & Cin);

  assign p_S0_26 = (n_not_A0 & B0 & A1 & n_not_B1 & A2 & n_not_B2 & Cin);
  assign p_S0_27 = (n_not_A0 & B0 & A1 & n_not_B1 & A2 & B2 & Cin);

  assign p_S0_28 = (n_not_A0 & B0 & A1 & B1 & n_not_A2 & n_not_B2 & Cin);

  assign p_S0_29 = (n_not_A0 & B0 & A1 & B1 & n_not_A2 & B2 & Cin);

  assign p_S0_3 = (n_not_A0 & n_not_B0 & n_not_A1 & n_not_B1 & A2 & B2 & n_not_Cin);

  assign p_S0_30 = (n_not_A0 & B0 & A1 & B1 & A2 & n_not_B2 & Cin);

  assign p_S0_31 = (n_not_A0 & B0 & A1 & B1 & A2 & B2 & Cin);

  assign p_S0_32 = (A0 & n_not_B0 & n_not_A1 & n_not_B1 & n_not_A2 & n_not_B2 & Cin);

  assign p_S0_33 = (A0 & n_not_B0 & n_not_A1 & n_not_B1 & n_not_A2 & B2 & Cin);

  assign p_S0_34 = (A0 & n_not_B0 & n_not_A1 & n_not_B1 & A2 & n_not_B2 & Cin);

  assign p_S0_35 = (A0 & n_not_B0 & n_not_A1 & n_not_B1 & A2 & B2 & Cin);

  assign p_S0_36 = (A0 & n_not_B0 & n_not_A1 & B1 & n_not_A2 & n_not_B2 & Cin);

  assign p_S0_37 = (A0 & n_not_B0 & n_not_A1 & B1 & n_not_A2 & B2 & Cin);

  assign p_S0_38 = (A0 & n_not_B0 & n_not_A1 & B1 & A2 & n_not_B2 & Cin);

  assign p_S0_39 = (A0 & n_not_B0 & n_not_A1 & B1 & A2 & B2 & Cin);

  assign p_S0_4 = (n_not_A0 & n_not_B0 & n_not_A1 & B1 & n_not_A2 & n_not_B2 & n_not_Cin);

  assign p_S0_40 = (A0 & n_not_B0 & A1 & n_not_B1 & n_not_A2 & n_not_B2 & Cin);

  assign p_S0_41 = (A0 & n_not_B0 & A1 & n_not_B1 & n_not_A2 & B2 & Cin);

  assign p_S0_42 = (A0 & n_not_B0 & A1 & n_not_B1 & A2 & n_not_B2 & Cin);

  assign p_S0_43 = (A0 & n_not_B0 & A1 & n_not_B1 & A2 & B2 & Cin);

  assign p_S0_44 = (A0 & n_not_B0 & A1 & B1 & n_not_A2 & n_not_B2 & Cin);

  assign p_S0_45 = (A0 & n_not_B0 & A1 & B1 & n_not_A2 & B2 & Cin);

  assign p_S0_46 = (A0 & n_not_B0 & A1 & B1 & A2 & n_not_B2 & Cin);

  assign p_S0_47 = (A0 & n_not_B0 & A1 & B1 & A2 & B2 & Cin);

  assign p_S0_48 = (A0 & B0 & n_not_A1 & n_not_B1 & n_not_A2 & n_not_B2 & Cin);

  assign p_S0_49 = (A0 & B0 & n_not_A1 & n_not_B1 & n_not_A2 & B2 & Cin);

  assign p_S0_5 = (n_not_A0 & n_not_B0 & n_not_A1 & B1 & n_not_A2 & B2 & n_not_Cin);

  assign p_S0_50 = (A0 & B0 & n_not_A1 & n_not_B1 & A2 & n_not_B2 & Cin);

  assign p_S0_51 = (A0 & B0 & n_not_A1 & n_not_B1 & A2 & B2 & Cin);

  assign p_S0_52 = (A0 & B0 & n_not_A1 & B1 & n_not_A2 & n_not_B2 & Cin);

  assign p_S0_53 = (A0 & B0 & n_not_A1 & B1 & n_not_A2 & B2 & Cin);

  assign p_S0_54 = (A0 & B0 & n_not_A1 & B1 & A2 & n_not_B2 & Cin);

  assign p_S0_55 = (A0 & B0 & n_not_A1 & B1 & A2 & B2 & Cin);

  assign p_S0_56 = (A0 & B0 & A1 & n_not_B1 & n_not_A2 & n_not_B2 & Cin);

  assign p_S0_57 = (A0 & B0 & A1 & n_not_B1 & n_not_A2 & B2 & Cin);

  assign p_S0_58 = (A0 & B0 & A1 & n_not_B1 & A2 & n_not_B2 & Cin);

  assign p_S0_59 = (A0 & B0 & A1 & n_not_B1 & A2 & B2 & Cin);

  assign p_S0_6 = (n_not_A0 & n_not_B0 & n_not_A1 & B1 & A2 & n_not_B2 & n_not_Cin);

  assign p_S0_60 = (A0 & B0 & A1 & B1 & n_not_A2 & n_not_B2 & Cin);

  assign p_S0_61 = (A0 & B0 & A1 & B1 & n_not_A2 & B2 & Cin);

  assign p_S0_62 = (A0 & B0 & A1 & B1 & A2 & n_not_B2 & Cin);

  assign p_S0_63 = (A0 & B0 & A1 & B1 & A2 & B2 & Cin);

  assign p_S0_7 = (n_not_A0 & n_not_B0 & n_not_A1 & B1 & A2 & B2 & n_not_Cin);

  assign p_S0_8 = (n_not_A0 & n_not_B0 & A1 & n_not_B1 & n_not_A2 & n_not_B2 & n_not_Cin);

  assign p_S0_9 = (n_not_A0 & n_not_B0 & A1 & n_not_B1 & n_not_A2 & B2 & n_not_Cin);

  assign p_S1_0 = (n_not_A0 & n_not_B0 & n_not_A1 & n_not_B1 & n_not_A2 & n_not_B2 & Cin);

  assign p_S1_1 = (n_not_A0 & n_not_B0 & n_not_A1 & n_not_B1 & n_not_A2 & B2 & Cin);

  assign p_S1_10 = (n_not_A0 & n_not_B0 & A1 & n_not_B1 & A2 & n_not_B2 & n_not_Cin);

  assign p_S1_11 = (n_not_A0 & n_not_B0 & A1 & n_not_B1 & A2 & B2 & n_not_Cin);

  assign p_S1_12 = (n_not_A0 & n_not_B0 & A1 & B1 & n_not_A2 & n_not_B2 & n_not_Cin);
  assign p_S1_13 = (n_not_A0 & n_not_B0 & A1 & B1 & n_not_A2 & B2 & n_not_Cin);

  assign p_S1_14 = (n_not_A0 & n_not_B0 & A1 & B1 & A2 & n_not_B2 & n_not_Cin);

  assign p_S1_15 = (n_not_A0 & n_not_B0 & A1 & B1 & A2 & B2 & n_not_Cin);

  assign p_S1_16 = (n_not_A0 & B0 & n_not_A1 & n_not_B1 & n_not_A2 & n_not_B2 & n_not_Cin);

  assign p_S1_17 = (n_not_A0 & B0 & n_not_A1 & n_not_B1 & n_not_A2 & B2 & n_not_Cin);

  assign p_S1_18 = (n_not_A0 & B0 & n_not_A1 & n_not_B1 & A2 & n_not_B2 & n_not_Cin);

  assign p_S1_19 = (n_not_A0 & B0 & n_not_A1 & n_not_B1 & A2 & B2 & n_not_Cin);

  assign p_S1_2 = (n_not_A0 & n_not_B0 & n_not_A1 & n_not_B1 & A2 & n_not_B2 & Cin);

  assign p_S1_20 = (n_not_A0 & B0 & n_not_A1 & B1 & n_not_A2 & n_not_B2 & Cin);

  assign p_S1_21 = (n_not_A0 & B0 & n_not_A1 & B1 & n_not_A2 & B2 & Cin);

  assign p_S1_22 = (n_not_A0 & B0 & n_not_A1 & B1 & A2 & n_not_B2 & Cin);

  assign p_S1_23 = (n_not_A0 & B0 & n_not_A1 & B1 & A2 & B2 & Cin);

  assign p_S1_24 = (n_not_A0 & B0 & A1 & n_not_B1 & n_not_A2 & n_not_B2 & Cin);

  assign p_S1_25 = (n_not_A0 & B0 & A1 & n_not_B1 & n_not_A2 & B2 & Cin);

  assign p_S1_26 = (n_not_A0 & B0 & A1 & n_not_B1 & A2 & n_not_B2 & Cin);

  assign p_S1_27 = (n_not_A0 & B0 & A1 & n_not_B1 & A2 & B2 & Cin);

  assign p_S1_28 = (n_not_A0 & B0 & A1 & B1 & n_not_A2 & n_not_B2 & Cin);

  assign p_S1_29 = (n_not_A0 & B0 & A1 & B1 & n_not_A2 & B2 & Cin);

  assign p_S1_3 = (n_not_A0 & n_not_B0 & n_not_A1 & n_not_B1 & A2 & B2 & Cin);

  assign p_S1_30 = (n_not_A0 & B0 & A1 & B1 & A2 & n_not_B2 & Cin);

  assign p_S1_31 = (n_not_A0 & B0 & A1 & B1 & A2 & B2 & Cin);

  assign p_S1_32 = (A0 & n_not_B0 & n_not_A1 & n_not_B1 & n_not_A2 & n_not_B2 & n_not_Cin);

  assign p_S1_33 = (A0 & n_not_B0 & n_not_A1 & n_not_B1 & n_not_A2 & B2 & n_not_Cin);

  assign p_S1_34 = (A0 & n_not_B0 & n_not_A1 & n_not_B1 & A2 & n_not_B2 & n_not_Cin);

  assign p_S1_35 = (A0 & n_not_B0 & n_not_A1 & n_not_B1 & A2 & B2 & n_not_Cin);

  assign p_S1_36 = (A0 & n_not_B0 & n_not_A1 & B1 & n_not_A2 & n_not_B2 & Cin);

  assign p_S1_37 = (A0 & n_not_B0 & n_not_A1 & B1 & n_not_A2 & B2 & Cin);

  assign p_S1_38 = (A0 & n_not_B0 & n_not_A1 & B1 & A2 & n_not_B2 & Cin);

  assign p_S1_39 = (A0 & n_not_B0 & n_not_A1 & B1 & A2 & B2 & Cin);

  assign p_S1_4 = (n_not_A0 & n_not_B0 & n_not_A1 & B1 & n_not_A2 & n_not_B2 & n_not_Cin);

  assign p_S1_40 = (A0 & n_not_B0 & A1 & n_not_B1 & n_not_A2 & n_not_B2 & Cin);

  assign p_S1_41 = (A0 & n_not_B0 & A1 & n_not_B1 & n_not_A2 & B2 & Cin);

  assign p_S1_42 = (A0 & n_not_B0 & A1 & n_not_B1 & A2 & n_not_B2 & Cin);

  assign p_S1_43 = (A0 & n_not_B0 & A1 & n_not_B1 & A2 & B2 & Cin);

  assign p_S1_44 = (A0 & n_not_B0 & A1 & B1 & n_not_A2 & n_not_B2 & Cin);

  assign p_S1_45 = (A0 & n_not_B0 & A1 & B1 & n_not_A2 & B2 & Cin);

  assign p_S1_46 = (A0 & n_not_B0 & A1 & B1 & A2 & n_not_B2 & Cin);

  assign p_S1_47 = (A0 & n_not_B0 & A1 & B1 & A2 & B2 & Cin);

  assign p_S1_48 = (A0 & B0 & n_not_A1 & n_not_B1 & n_not_A2 & n_not_B2 & n_not_Cin);

  assign p_S1_49 = (A0 & B0 & n_not_A1 & n_not_B1 & n_not_A2 & B2 & n_not_Cin);

  assign p_S1_5 = (n_not_A0 & n_not_B0 & n_not_A1 & B1 & n_not_A2 & B2 & n_not_Cin);

  assign p_S1_50 = (A0 & B0 & n_not_A1 & n_not_B1 & A2 & n_not_B2 & n_not_Cin);

  assign p_S1_51 = (A0 & B0 & n_not_A1 & n_not_B1 & A2 & B2 & n_not_Cin);

  assign p_S1_52 = (A0 & B0 & n_not_A1 & B1 & n_not_A2 & n_not_B2 & Cin);

  assign p_S1_53 = (A0 & B0 & n_not_A1 & B1 & n_not_A2 & B2 & Cin);

  assign p_S1_54 = (A0 & B0 & n_not_A1 & B1 & A2 & n_not_B2 & Cin);

  assign p_S1_55 = (A0 & B0 & n_not_A1 & B1 & A2 & B2 & Cin);

  assign p_S1_56 = (A0 & B0 & A1 & n_not_B1 & n_not_A2 & n_not_B2 & Cin);

  assign p_S1_57 = (A0 & B0 & A1 & n_not_B1 & n_not_A2 & B2 & Cin);
  assign p_S1_58 = (A0 & B0 & A1 & n_not_B1 & A2 & n_not_B2 & Cin);

  assign p_S1_59 = (A0 & B0 & A1 & n_not_B1 & A2 & B2 & Cin);

  assign p_S1_6 = (n_not_A0 & n_not_B0 & n_not_A1 & B1 & A2 & n_not_B2 & n_not_Cin);

  assign p_S1_60 = (A0 & B0 & A1 & B1 & n_not_A2 & n_not_B2 & Cin);

  assign p_S1_61 = (A0 & B0 & A1 & B1 & n_not_A2 & B2 & Cin);

  assign p_S1_62 = (A0 & B0 & A1 & B1 & A2 & n_not_B2 & Cin);

  assign p_S1_63 = (A0 & B0 & A1 & B1 & A2 & B2 & Cin);

  assign p_S1_7 = (n_not_A0 & n_not_B0 & n_not_A1 & B1 & A2 & B2 & n_not_Cin);

  assign p_S1_8 = (n_not_A0 & n_not_B0 & A1 & n_not_B1 & n_not_A2 & n_not_B2 & n_not_Cin);

  assign p_S1_9 = (n_not_A0 & n_not_B0 & A1 & n_not_B1 & n_not_A2 & B2 & n_not_Cin);

  assign p_S2_0 = (n_not_A0 & n_not_B0 & n_not_A1 & n_not_B1 & n_not_A2 & n_not_B2 & n_not_Cin);

  assign p_S2_1 = (n_not_A0 & n_not_B0 & n_not_A1 & n_not_B1 & n_not_A2 & B2 & Cin);

  assign p_S2_10 = (n_not_A0 & n_not_B0 & A1 & n_not_B1 & A2 & n_not_B2 & n_not_Cin);

  assign p_S2_11 = (n_not_A0 & n_not_B0 & A1 & n_not_B1 & A2 & B2 & n_not_Cin);

  assign p_S2_12 = (n_not_A0 & n_not_B0 & A1 & B1 & n_not_A2 & n_not_B2 & Cin);

  assign p_S2_13 = (n_not_A0 & n_not_B0 & A1 & B1 & n_not_A2 & B2 & n_not_Cin);

  assign p_S2_14 = (n_not_A0 & n_not_B0 & A1 & B1 & A2 & n_not_B2 & n_not_Cin);

  assign p_S2_15 = (n_not_A0 & n_not_B0 & A1 & B1 & A2 & B2 & n_not_Cin);

  assign p_S2_16 = (n_not_A0 & B0 & n_not_A1 & n_not_B1 & n_not_A2 & n_not_B2 & Cin);

  assign p_S2_17 = (n_not_A0 & B0 & n_not_A1 & n_not_B1 & n_not_A2 & B2 & n_not_Cin);

  assign p_S2_18 = (n_not_A0 & B0 & n_not_A1 & n_not_B1 & A2 & n_not_B2 & n_not_Cin);

  assign p_S2_19 = (n_not_A0 & B0 & n_not_A1 & n_not_B1 & A2 & B2 & n_not_Cin);

  assign p_S2_2 = (n_not_A0 & n_not_B0 & n_not_A1 & n_not_B1 & A2 & n_not_B2 & Cin);

  assign p_S2_20 = (n_not_A0 & B0 & n_not_A1 & B1 & n_not_A2 & n_not_B2 & n_not_Cin);

  assign p_S2_21 = (n_not_A0 & B0 & n_not_A1 & B1 & n_not_A2 & B2 & Cin);

  assign p_S2_22 = (n_not_A0 & B0 & n_not_A1 & B1 & A2 & n_not_B2 & Cin);

  assign p_S2_23 = (n_not_A0 & B0 & n_not_A1 & B1 & A2 & B2 & Cin);

  assign p_S2_24 = (n_not_A0 & B0 & A1 & n_not_B1 & n_not_A2 & n_not_B2 & n_not_Cin);

  assign p_S2_25 = (n_not_A0 & B0 & A1 & n_not_B1 & n_not_A2 & B2 & Cin);

  assign p_S2_26 = (n_not_A0 & B0 & A1 & n_not_B1 & A2 & n_not_B2 & Cin);

  assign p_S2_27 = (n_not_A0 & B0 & A1 & n_not_B1 & A2 & B2 & Cin);

  assign p_S2_28 = (n_not_A0 & B0 & A1 & B1 & n_not_A2 & n_not_B2 & n_not_Cin);

  assign p_S2_29 = (n_not_A0 & B0 & A1 & B1 & n_not_A2 & B2 & Cin);

  assign p_S2_3 = (n_not_A0 & n_not_B0 & n_not_A1 & n_not_B1 & A2 & B2 & Cin);

  assign p_S2_30 = (n_not_A0 & B0 & A1 & B1 & A2 & n_not_B2 & Cin);

  assign p_S2_31 = (n_not_A0 & B0 & A1 & B1 & A2 & B2 & Cin);

  assign p_S2_32 = (A0 & n_not_B0 & n_not_A1 & n_not_B1 & n_not_A2 & n_not_B2 & Cin);

  assign p_S2_33 = (A0 & n_not_B0 & n_not_A1 & n_not_B1 & n_not_A2 & B2 & n_not_Cin);

  assign p_S2_34 = (A0 & n_not_B0 & n_not_A1 & n_not_B1 & A2 & n_not_B2 & n_not_Cin);

  assign p_S2_35 = (A0 & n_not_B0 & n_not_A1 & n_not_B1 & A2 & B2 & n_not_Cin);

  assign p_S2_36 = (A0 & n_not_B0 & n_not_A1 & B1 & n_not_A2 & n_not_B2 & n_not_Cin);

  assign p_S2_37 = (A0 & n_not_B0 & n_not_A1 & B1 & n_not_A2 & B2 & Cin);

  assign p_S2_38 = (A0 & n_not_B0 & n_not_A1 & B1 & A2 & n_not_B2 & Cin);

  assign p_S2_39 = (A0 & n_not_B0 & n_not_A1 & B1 & A2 & B2 & Cin);

  assign p_S2_4 = (n_not_A0 & n_not_B0 & n_not_A1 & B1 & n_not_A2 & n_not_B2 & Cin);

  assign p_S2_40 = (A0 & n_not_B0 & A1 & n_not_B1 & n_not_A2 & n_not_B2 & n_not_Cin);

  assign p_S2_41 = (A0 & n_not_B0 & A1 & n_not_B1 & n_not_A2 & B2 & Cin);

  assign p_S2_42 = (A0 & n_not_B0 & A1 & n_not_B1 & A2 & n_not_B2 & Cin);

  assign p_S2_43 = (A0 & n_not_B0 & A1 & n_not_B1 & A2 & B2 & Cin);
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  assign p_S2_44 = (A0 & n_not_B0 & A1 & B1 & n_not_A2 & n_not_B2 & n_not_Cin);

  assign p_S2_45 = (A0 & n_not_B0 & A1 & B1 & n_not_A2 & B2 & Cin);

  assign p_S2_46 = (A0 & n_not_B0 & A1 & B1 & A2 & n_not_B2 & Cin);

  assign p_S2_47 = (A0 & n_not_B0 & A1 & B1 & A2 & B2 & Cin);

  assign p_S2_48 = (A0 & B0 & n_not_A1 & n_not_B1 & n_not_A2 & n_not_B2 & Cin);

  assign p_S2_49 = (A0 & B0 & n_not_A1 & n_not_B1 & n_not_A2 & B2 & n_not_Cin);

  assign p_S2_5 = (n_not_A0 & n_not_B0 & n_not_A1 & B1 & n_not_A2 & B2 & n_not_Cin);

  assign p_S2_50 = (A0 & B0 & n_not_A1 & n_not_B1 & A2 & n_not_B2 & n_not_Cin);

  assign p_S2_51 = (A0 & B0 & n_not_A1 & n_not_B1 & A2 & B2 & n_not_Cin);

  assign p_S2_52 = (A0 & B0 & n_not_A1 & B1 & n_not_A2 & n_not_B2 & n_not_Cin);

  assign p_S2_53 = (A0 & B0 & n_not_A1 & B1 & n_not_A2 & B2 & Cin);

  assign p_S2_54 = (A0 & B0 & n_not_A1 & B1 & A2 & n_not_B2 & Cin);

  assign p_S2_55 = (A0 & B0 & n_not_A1 & B1 & A2 & B2 & Cin);

  assign p_S2_56 = (A0 & B0 & A1 & n_not_B1 & n_not_A2 & n_not_B2 & n_not_Cin);

  assign p_S2_57 = (A0 & B0 & A1 & n_not_B1 & n_not_A2 & B2 & Cin);

  assign p_S2_58 = (A0 & B0 & A1 & n_not_B1 & A2 & n_not_B2 & Cin);

  assign p_S2_59 = (A0 & B0 & A1 & n_not_B1 & A2 & B2 & Cin);

  assign p_S2_6 = (n_not_A0 & n_not_B0 & n_not_A1 & B1 & A2 & n_not_B2 & n_not_Cin);

  assign p_S2_60 = (A0 & B0 & A1 & B1 & n_not_A2 & n_not_B2 & n_not_Cin);

  assign p_S2_61 = (A0 & B0 & A1 & B1 & n_not_A2 & B2 & Cin);

  assign p_S2_62 = (A0 & B0 & A1 & B1 & A2 & n_not_B2 & Cin);

  assign p_S2_63 = (A0 & B0 & A1 & B1 & A2 & B2 & Cin);

  assign p_S2_7 = (n_not_A0 & n_not_B0 & n_not_A1 & B1 & A2 & B2 & n_not_Cin);

  assign p_S2_8 = (n_not_A0 & n_not_B0 & A1 & n_not_B1 & n_not_A2 & n_not_B2 & Cin);

  assign p_S2_9 = (n_not_A0 & n_not_B0 & A1 & n_not_B1 & n_not_A2 & B2 & n_not_Cin);


endmodule
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Prompt for binary-bcd:

You are an expert in logic design. Provide CNF equations in the format NAME = CNF_EXPRESSION, using ∧ for AND, ∨ for OR, and ! for NOT.

Give me the CNF (conjunctive normal form) equation for a 5-bit binary to BCD converter. Assume a 5-bit binary input B4, B3, B2, B1, B0 and a 6-bit BCD output, where T1, T0 are the two bits for the tens digit and U3, U2, U1, U0 are the four bits for the units digit. Just return the equations for T1, T0, U3, U2, U1, U0 in the specified format.

LLM	No. of iterations to get correct CNF (including changing prompts)	Correct CNF
GPT-4o-mini	2 reruns	Yes
Gemini 2.5 pro	2 reruns	Yes
Claude Sonnet 4	1	Yes

Difficulty:

The response from LLM needed to be regenerated again and again because sometimes it does not follow the specified format. Prompt needed to be changed in order to get the response in a way that when it is given as input to parse, the code can find the equation it needs to.

Conclusion:

Claude Sonnet 4 performed best overall, requiring the fewest iterations and showing excellent format compliance. **Gemini 2.5 Pro was consistently reliable**, while **GPT-4o-mini struggled with format compliance** and needed multiple prompt modifications.

With ALU it struggled with XOR operator in CNF which was frequent in GPT response, even after changing format.

Although using this flow may be the best way to get correct Verilog code at once, using CNF equations but it is not at all optimised code.