The disjunctive decomposition benchmarks were obtained by considering sequential circuits from the HWMCC10 benchmark suite, and by formulating the problem of disjunctively decomposing the circuit into components as a problem of synthesizing Skolem function vectors. Each benchmark is of the form $\exists Y.\, F(X, Y)$, where $F(X, Y)$ is an arbitrary Boolean formula, and was generated in the following manner.

The HWMCC10 benchmarks are circuits in *.aig* format. In order to generate the benchmarks, we first read the circuit, and then extracted the symbolic transition function of the circuit. Let $(x'_1 = f_1(X, Y)) \wedge \ldots \wedge (x'_n = f_n(X, Y))$ be the symbolic transition function extracted, where $X = (x_1, \ldots, x_n)$ is the present state, $X' = (x'_1, \ldots, x'_n)$ is the next state, $Y = (y_1, \ldots, y_m)$ are the inputs, and $f_1, \ldots, f_n$ are transition functions for the state variables $x_1, \ldots, x_n$ respectively.

The disjunctive decomposition benchmark generated is of the form $\exists Y.\, ((x_1 \neq f_1(X, Y)) \vee \ldots \vee (x_n \neq f_n(X, Y)))$. Note that for a given state $X$, a value of variables in $Y$ that satisfies the formula $(x_1 \neq f_1(X, Y)) \vee \ldots \vee (x_n \neq f_n(X, Y))$ gives an outgoing edge from $X$ which is not a self-loop. Hence the benchmark describes the problem: *Synthesize Skolem functions for $Y$ such that the outgoing edge is not a self-loop.*