For combinations cells (depending on number of inputs – example, inverter has only A input), the following characterizations have to be performed and filled. Remove all unwanted rows.

1. **Input pin capacitances:**

|  |  |  |  |
| --- | --- | --- | --- |
| **Input Pins** | **Rise Cap (pF)** | **Fall Cap (pF)** | **Average Cap (pF)** |
| A | 1.778 | 1.5454 | 1.6617 |
| B | 2.336 | 2.229 | 2.2825 |
|  |  |  |  |

1. **Transition Time Table:** (please strictly consider 20% and 80% of VDD for transition time)

**(i) Output Rise Transitions** **(in ns)** [Input slew vs output capacitance].

**Related pin A**: (i.e., other input pins are held constant)

|  |  |  |  |
| --- | --- | --- | --- |
|  | **10 ps** | **100 ps** | **1000 ps** |
| **0.5 fF** | 0.05465 | 0.07927 | 0.15 |
| **10 fF** | 0.11555 | 0.1369 | 0.2324 |
| **100 fF** | 0.7158 | 0.6737 | 0.851 |

**Related pin B**: (i.e., other input pins are held constant)

|  |  |  |  |
| --- | --- | --- | --- |
|  | **10 ps** | **100 ps** | **1000 ps** |
| **0.5 fF** | 0.06046 | 0.08536 | 0.18 |
| **10 fF** | 0.11333 | 0.1368 | 0.2978 |
| **100 fF** | 0.5895 | 0.5474 | 0.745 |

**(ii) Output Fall Transitions** **(in ns)** [Input slew vs output capacitance].

**Related pin A**: (i.e., other input pins are held constant)

|  |  |  |  |
| --- | --- | --- | --- |
|  | **10 ps** | **100 ps** | **1000 ps** |
| **0.5 fF** | 0.03264 | 0.0349 | 0.0404 |
| **10 fF** | 0.1172 | 0.1191 | 0.1133 |
| **100 fF** | 0.9278 | 0.9254 | 0.9151 |

**Related pin B**: (i.e., other input pins are held constant)

|  |  |  |  |
| --- | --- | --- | --- |
|  | **10 ps** | **100 ps** | **1000 ps** |
| **0.5 fF** | 0.01697 | 0.01584 | 0.075 |
| **10 fF** | 0.0966 | 0.0985 | 0.177 |
| **100 fF** | 0.87 | 0.9 | 0.915 |

1. **Propagation delay time tables**: (unlike textbook definitions that we used for our assignments, here we will use 50% of input to 50% of output to simulate propagation delay – by keeping other inputs fixed).

**(i) Cell Rise Delay (in ns)** [Input slew vs output capacitance].

**Related pin A**: (i.e., other input pins are held constant)

|  |  |  |  |
| --- | --- | --- | --- |
|  | **10 ps** | **100 ps** | **1000 ps** |
| **0.5 fF** | 0.12337 | 0.1474 | 0.2475 |
| **10 fF** | 0.2772 | 0.3556 | 0.4 |
| **100 fF** | 1.6444 | 1.7263 | 1.8025 |

**Related pin B**: (i.e., other input pins are held constant)

|  |  |  |  |
| --- | --- | --- | --- |
|  | **10 ps** | **100 ps** | **1000 ps** |
| **0.5 fF** | 0.06078 | 0.06771 | 0.2381 |
| **10 fF** | 0.2222 | 0.2222 | 0.421 |
| **100 fF** | 1.466 | 1.532 | 1.759 |

**(ii) Cell Fall Delay (in ns)** [Input slew vs output capacitance].

**Related pin A**: (i.e., other input pins are held constant)

|  |  |  |  |
| --- | --- | --- | --- |
|  | **10 ps** | **100 ps** | **1000 ps** |
| **0.5 fF** | 0.11429 | 0.1263 | 0.2673 |
| **10 fF** | 0.1881 | 0.2222 | 0.353 |
| **100 fF** | 0.8 | 0.8421 | 1.0124 |

**Related pin B**: (i.e., other input pins are held constant)

|  |  |  |  |
| --- | --- | --- | --- |
|  | **10 ps** | **100 ps** | **1000 ps** |
| **0.5 fF** | 0.03137 | 0.04167 | 0.059 |
| **10 fF** | 0.0926 | 0.1111 | 0.21 |
| **100 fF** | 0.776 | 0.645 | 1.018 |

1. **Static Power (cover all possible input combinations based on number of inputs).**

|  |  |
| --- | --- |
| **Condition (ABC)** | **Power** |
| 00 | 6pW |
| 01 | 4.9266pW |
| 10 | 1.07085nW |
| 11 | 1.06748nW |

1. **Dynamic Power Table:**

**(i) Rise Power (in nW)** [Input slew vs output capacitance].

**Related pin A**: (i.e., other input pins are held constant)

|  |  |  |  |
| --- | --- | --- | --- |
|  | **10 ps** | **100 ps** | **1000 ps** |
| **0.5 fF** | 818 | 33.156684 | 1,583 |
| **10 fF** | 356.51 | 1,721.6 | 2,936 |
| **100 fF** | 18,220 | 11,378 | 11,670 |

**Related pin B**: (i.e., other input pins are held constant)

|  |  |  |  |
| --- | --- | --- | --- |
|  | **10 ps** | **100 ps** | **1000 ps** |
| **0.5 fF** | 6,366.15 | 4,653.126 | 1,516.1 |
| **10 fF** | 594.765 | 284.94 | 152.779 |
| **100 fF** | 287.9 | 83.79466 | 228.39 |

**(ii) Fall Power (in nW)** [Input slew vs output capacitance].

**Related pin A**: (i.e., other input pins are held constant)

|  |  |  |  |
| --- | --- | --- | --- |
|  | **10 ps** | **100 ps** | **1000 ps** |
| **0.5 fF** | 954.7 | 1,020 | 812.37 |
| **10 fF** | 1,680.5 | 882.47 | 722.7 |
| **100 fF** | 993.983 | 5,546.5 | 1,793.346 |

**Related pin B**: (i.e., other input pins are held constant)

|  |  |  |  |
| --- | --- | --- | --- |
|  | **10 ps** | **100 ps** | **1000 ps** |
| **0.5 fF** | 52.2350775 | 19,922.4 | 568.84 |
| **10 fF** | 3,192.1 | 1,633.82 | 2,022.57 |
| **100 fF** | 19,120 | 9,968 | 9,701 |