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 (fF)** | **Fall Cap (fF)** | **Average Cap (fF)** |
| A | 2.609 | 2.605 | 2.607 |
| B | 4.514 | 4.409 | 4.461 |
| C | 3.977 | 3.921 | 3.949 |

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

**(i) Output Rise Transitions** **(in ps)** [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** | 30.79 | 30.8 | 42.9 |
| **10 fF** | 83.2 | 83.2 | 88 |
| **100 fF** | 593 | 594 | 594 |

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

|  |  |  |  |
| --- | --- | --- | --- |
|  | **10 ps** | **100 ps** | **1000 ps** |
| **0.5 fF** | 35.6 | 36.59 | 126.1 |
| **10 fF** | 89.4 | 89 | 189.6 |
| **100 fF** | 600 | 600 | 625 |

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

|  |  |  |  |
| --- | --- | --- | --- |
|  | **10 ps** | **100 ps** | **1000 ps** |
| **0.5 fF** | 44.1 | 44.0 | 133.1 |
| **10 fF** | 98.3 | 97.8 | 195.2 |
| **100 fF** | 608 | 608 | 629 |

**(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** | 140.2 | 140 | 141 |
| **10 fF** | 364 | 364 | 365 |
| **100 fF** | 2469 | 2470 | 2470 |

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

|  |  |  |  |
| --- | --- | --- | --- |
|  | **10 ps** | **100 ps** | **1000 ps** |
| **0.5 fF** | 146.9 | 146.9 | 211.6 |
| **10 fF** | 369.6 | 370 | 391.7 |
| **100 fF** | 2473 | 2473 | 2473 |

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

|  |  |  |  |
| --- | --- | --- | --- |
|  | **10 ps** | **100 ps** | **1000 ps** |
| **0.5 fF** | 146.9 | 146.9 | 175.8 |
| **10 fF** | 369 | 369 | 385.4 |
| **100 fF** | 2473 | 2473 | 2473 |

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 ps)** [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** | 78.2 | 97 | 206 |
| **10 fF** | 117 | 136 | 250 |
| **100 fF** | 467 | 486 | 600 |

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

|  |  |  |  |
| --- | --- | --- | --- |
|  | **10 ps** | **100 ps** | **1000 ps** |
| **0.5 fF** | 34.91 | 58.6 | 170.6 |
| **10 fF** | 72.7 | 96 | 269.8 |
| **100 fF** | 342 | 370 | 636.5 |

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

|  |  |  |  |
| --- | --- | --- | --- |
|  | **10 ps** | **100 ps** | **1000 ps** |
| **0.5 fF** | 38.3 | 61.7 | 196.7 |
| **10 fF** | 78.4 | 101 | 285.6 |
| **100 fF** | 349 | 377 | 651 |

**(ii) Cell Fall Delay (in ps)** [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** | 135.6 | 155 | 265 |
| **10 fF** | 307 | 328 | 436 |
| **100 fF** | 1540 | 1656 | 2013 |

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

|  |  |  |  |
| --- | --- | --- | --- |
|  | **10 ps** | **100 ps** | **1000 ps** |
| **0.5 fF** | 137.16 | 152.6 | 331.7 |
| **10 fF** | 305.8 | 324 | 532.8 |
| **100 fF** | 1889 | 1911 | 2125 |

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

|  |  |  |  |
| --- | --- | --- | --- |
|  | **10 ps** | **100 ps** | **1000 ps** |
| **0.5 fF** | 147.6 | 157.1 | 230.3 |
| **10 fF** | 316 | 329 | 416 |
|  | 1899 | 1916 | 2009 |

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

|  |  |
| --- | --- |
| **Condition (ABC)** | **Power (nW)** |
| 000 | 0.131 |
| 001 | 0.132 |
| 010 | 0.145 |
| 011 | 0.270 |
| 100 | 0.227 |
| 101 | 0.227 |
| 110 | 0.227 |
| 111 | 0.227 |

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** | 797 | 947 | 1054 |
| **10 fF** | 763 | 938 | 1058 |
| **100 fF** | 741 | 928 | 1059 |

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

|  |  |  |  |
| --- | --- | --- | --- |
|  | **10 ps** | **100 ps** | **1000 ps** |
| **0.5 fF** | 1841 | 11650 | 104095 |
| **10 fF** | 1640 | 9335 | 85972 |
| **100 fF** | 1527 | 8302 | 75856 |

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

|  |  |  |  |
| --- | --- | --- | --- |
|  | **10 ps** | **100 ps** | **1000 ps** |
| **0.5 fF** | 873 | 1014 | 1098 |
| **10 fF** | 694 | 822 | 1062 |
| **100 fF** | 596 | 621 | 806 |

**(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** | 1139 | 3855 | 15385 |
| **10 fF** | 1179 | 4142 | 11300 |
| **100 fF** | 1195 | 4410 | 9781 |

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

|  |  |  |  |
| --- | --- | --- | --- |
|  | **10 ps** | **100 ps** | **1000 ps** |
| **0.5 fF** | 1144 | 3482 | 8559 |
| **10 fF** | 1182 | 3715 | 7965 |
| **100 fF** | 1195 | 4194 | 8565 |

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

|  |  |  |  |
| --- | --- | --- | --- |
|  | **10 ps** | **100 ps** | **1000 ps** |
| **0.5 fF** | 1229 | 4767 | 11848 |
| **10 fF** | 1328 | 6654 | 27338 |
| **100 fF** | 1323 | 7361 | 42693 |