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 | 0.00462497 | 0.00602716 | 0.005326065 |
| B | 0.00448485 | 0.00465675 | 0.0045708 |

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** | 0.01539466 | 0.01547622 | 0.02958543 |
| **10 fF** | 0.05144221 | 0.05148681 | 0.06026555 |
| **100 fF** | 0.4182916 | 0.4182920 | 0.4195159 |

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

|  |  |  |  |
| --- | --- | --- | --- |
|  | **10 ps** | **100 ps** | **1000 ps** |
| **0.5 fF** | 0.01539688 | 0.01541975 | 0.02751254 |
| **10 fF** | 0.05144127 | 0.5145858 | 0.06033947 |
| **100 fF** | 0.4182919 | 0.4182918 | 0.4189343 |

**(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** | 0.01406769 | 0.01424817 | 0.02768933 |
| **10 fF** | 0.05216832 | 0.05223724 | 0.06311020 |
| **100 fF** | 0.4298037 | 0.4298035 | 0.4310851 |

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

|  |  |  |  |
| --- | --- | --- | --- |
|  | **10 ps** | **100 ps** | **1000 ps** |
| **0.5 fF** | 0.0149436 | 0.01465945 | 0.02632110 |
| **10 fF** | 0.05261857 | 0.05265927 | 0.06146541 |
| **100 fF** | 0.4300808 | 0.4300807 | 0.4311758 |

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** | 0.05118969 | 0.06875613 | 0.1426185 |
| **10 fF** | 0.08253108 | 0.09999442 | 0.1842102 |
| **100 fF** | 0.3351646 | 0.3527609 | 0.4395594 |

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

|  |  |  |  |
| --- | --- | --- | --- |
|  | **10 ps** | **100 ps** | **1000 ps** |
| **0.5 fF** | 0.05789580 | 0.07530663 | 0.1514517 |
| **10 fF** | 0.08925223 | 0.1066019 | 0.1930414 |
| **100 fF** | 0.3418901 | 0.3593189 | 0.4485244 |

**(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** | 0.04998945 | 0.07091995 | 0.1689967 |
| **10 fF** | 0.08547116 | 0.1063491 | 0.2163745 |
| **100 fF** | 0.3758042 | 0.3970541 | 0.5118230 |

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

|  |  |  |  |
| --- | --- | --- | --- |
|  | **10 ps** | **100 ps** | **1000 ps** |
| **0.5 fF** | 0.05730482 | 0.07859827 | 0.1955355 |
| **10 fF** | 0.09324168 | 0.1144115 | 0.2409657 |
| **100 fF** | 0.3842499 | 0.4056451 | 0.5360174 |

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

|  |  |
| --- | --- |
| **Condition (AB)** | **Power (nW)** |
| 00 | 0.503887 |
| 01 | 0.504168 |
| 10 | 0.509184 |
| 11 | 1.23724 |

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** | 117 | 57.06 | 53.28 |
| **10 fF** | 521.1 | 169.2 | 151.2 |
| **100 fF** | 263.7 | 255.6 | 222.3 |

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

|  |  |  |  |
| --- | --- | --- | --- |
|  | **10 ps** | **100 ps** | **1000 ps** |
| **0.5 fF** | 67.5 | 66.2535 | 63 |
| **10 fF** | 194.4 | 189.27 | 171.9 |
| **100 fF** | 294.03 | 285.3 | 252 |

**(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** | 65.7 | 64.62 | 54.63 |
| **10 fF** | 186.3 | 186.75 | 186.69 |
| **100 fF** | 285.3 | 286.2 | 286.2 |

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

|  |  |  |  |
| --- | --- | --- | --- |
|  | **10 ps** | **100 ps** | **1000 ps** |
| **0.5 fF** | 73.26 | 73.611 | 73.98 |
| **10 fF** | 204.651 | 205.02 | 205.56 |
| **100 fF** | 312.6825 | 313.65 | 313.47 |