

Homework 10

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Semiconductor Development Fundamentals

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You are working at a fabless company, and need to find a foundry to make 1,000 chips. This is a small production run. You talk to two potential vendors.

Vendor A says that they are using a slightly older, more mature, technology on 200 mm diameter wafers, with a defect density of only 0.2 cm^{-2} . You estimate you will need 1 cm^2 of area to make a single die using their process. The photomask cost (one-time cost) is \$100,000. The cost per wafer is \$3,000.

Vendor B is using a newer process (1 generation newer) with 300 mm diameter wafers. The feature size for Vendor B is 0.7x the feature size for Vendor A, so each die takes up $\frac{1}{2}$ the area. However, their defect density is 0.4 cm^{-2} (2x higher), the wafer cost is \$6,000 (2x higher), and the photomask cost is 2x higher (\$200,000).

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1.1 FILL IN THE FOLLOWING TABLE.

1000 Chips

variable	Vendor A	Vendor B
Photomask cost	\$ 100,000.00	\$ 200,000.00
Wafer diameter (cm)	20	30
Wafer cost	\$ 3,000.00	\$ 6,000.00
Defect density	0.2	0.4
Chip area (cm^2)	1	0.5
# chips / wafer	20	60
Yield	0.818730753	0.818730753
# good chips / wafer (round down)	16	49
# wafers required	63	21
Total run cost (wafers + photomask)	\$ 289,000.00	\$ 326,000.00
Cost per chip (total run cost / 1000 chips)	\$ 289.00	\$ 326.00

1.2 WHICH VENDOR WOULD YOU CHOOSE FOR THE INITIAL RUN?

Vendor A. It is cheaper.

You change jobs, and are now working for a company that makes chips for a big market. You will need to produce 1,000,000 chips per year. All the other parameters remain the same (same vendors, same chip size).

Make a new table for making 1,000,000 chips. What is the cost per chip for each vendor? Which vendor would you choose to produce the 1,000,000 chips?

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2.1 FILL IN THE FOLLOWING TABLE.

1,000,000 Chips

variable	Vendor A	Vendor B
Photomask cost	\$ 100,000.00	\$ 200,000.00
Wafer diameter (cm)	20	30
Wafer cost	\$ 3,000.00	\$ 6,000.00
Defect density	0.2	0.4
Chip area (cm ²)	1	0.5
# chips / wafer	20	60
Yield	0.818730753	0.818730753
# good chips / wafer (round down)	16	49
# wafers required	62500	20409
Total run cost (wafers + photomask	\$ 187,600,000.00	\$ 122,654,000.00
Cost per chip (total run cost / 1000 chips)	\$ 187.60	\$ 122.65

2.2 WHICH VENDOR WOULD YOU CHOOSE?

Vendor B. It is cheaper.