CASE STUDY 1:

1.1 a. Assuming wafer yield is 100%.

Yield = (1*1/(1+2*0.04))^14 = **0.34**

b. Manufacturing size of BlueDragon > manufacturing size of Phoenix. This suggests that bluedragon has an older plant than phoenix. The process gets tuned as the plant becomes old. Hence defect rate of phoenix (newer plant) is higher than bluedragon.

1.2 a. Dies per wafer = pi*((45/2)^2)/2 – pi*45/(2*2)^0.5 = 724

Yield = (1*1/(1+2*0.04))^14 = **0.34**

Profit = 724*0.34*30 = **$7385**

b. Dies per wafer =. (pi*((45/2)^2)/1.2) – (pi*45/(2*1.2)^0.5) = 1234

Yield = (1*1/(1+1.2*0.04))^14 = **0.52**

Profit = 1234*0.52*15 = **$9625**

c. No of wafers of reddragon chips = 50000/1234 = 40

No of wafers of phoenix chips = 25000/724 = 34

Since the capacity to fabricate is 70 wafers a month- I would make 40 wafers of reddragon chips and 30 of phoenix.

1.3 a. -3 According to the problem, we should assume that all 8 cores are independent. So this is a statistic problem where Combination is 8 cores. Only talking about 1, 2, 4 cores is not enough.

1.3 a. Yield for defect-free single core = (1*1/(1+2/8*0.04))^14 = 0.87

Yield for $phoenix^1$ = **0.87**

Yield for $phoenix^2$ = ((1*1/(1+2/8*3*0.04))^14 + (1*1/(1+2/8*2*0.04))^14)/2 = **0.71**

Yield for $phoenix^4$ = ((1*1/(1+2/8*4*0.04))^14 + (1*1/(1+2/8*5*0.04))^14 + (1*1/(1+2/8*6*0.04))^14 + (1*1/(1+2/8*7*0.04))^14)/4 = **0.48**

b. The answer is wrong because of a

b. Chips on $phoenix^1$ and $phoenix^2$ are worthwhile to sell because their yield is much higher than the higher versions of $phoenix^n$.

CASE STUDY 2:

1.4 a. -2 Time changes to 1/8, power changes to 1/8 not 8

1.4 a. $Energy_{dynamic} \propto$ Capacitive load*$voltage^2$

i.e. does not depend on clock time. Therefore, the dynamic power = power at full power

$Power_{dynamic} \propto$ 0.5*Capacitive load*$voltage^2$*frequency switched

$Power_{dynamic}$ / $Power_{old}$ **=** frequency $switched_{dynamic}$/ frequency $switched_{old}$ = 8/1

The dynamic power is 8 times the old power.

b. $Power_{dynamic}$ / $Power_{old}$ **=** frequency $switched_{dynamic}$*$voltage_{dynamic}^2$/ frequency $switched_{old}$ * $voltage_{old}^2$ = 1/8*(1/8)^2 = 1/512

$Energy_{dynamic}$ / $Energy_{old}$ = $voltage_{dynamic}^2$/ $voltage_{old}^2$ = $(1/8)^2$ = 1/64

c. -1 According to the question, here frequency change to 1/8 but voltage can only reduce to 1/2, you didn't use 1/8 for frequency

c. $Energy_{dynamic}$ / $Energy_{old}$ = $voltage_{dynamic}^2$/ $voltage_{old}^2$ = 0.5^2 = 0.25.
75% energy is saved in this case.

$Power_{dynamic}$ / $Power_{old}$ = frequency $switched_{dynamic*}voltage_{dynamic}^2$/ frequency $switched_{old}$ * $voltage_{old}^2$ = 0.25 * frequency $switched_{dynamic}$/ frequency $switched_{old}$
Since, the frequency is dropping, dynamic power will always be lower as compared to the old power.

1.5 a. $Speedup_{overall}$ = 1/((1-f)+f/N) = 1/((1-0.8)+0.8/4) = 5/2
Frequency and voltage need to be increased by **40%** (2/5).

1.5 b. -2 First the question is about Dynamic energy, and you forget there are 4 cores

b. $Power_{dynamic}$ / $Power_{old}$ = $(0.4V)^2$*0.4f*C/V^2*f*C = **0.064**
Dynamic power decreases by 93.6%.

c.

1.7 a. -1 See from chapter1 part1, Moore's law is 40-55% per year. And you don't need to care about the time limited since it is a theoretical value.

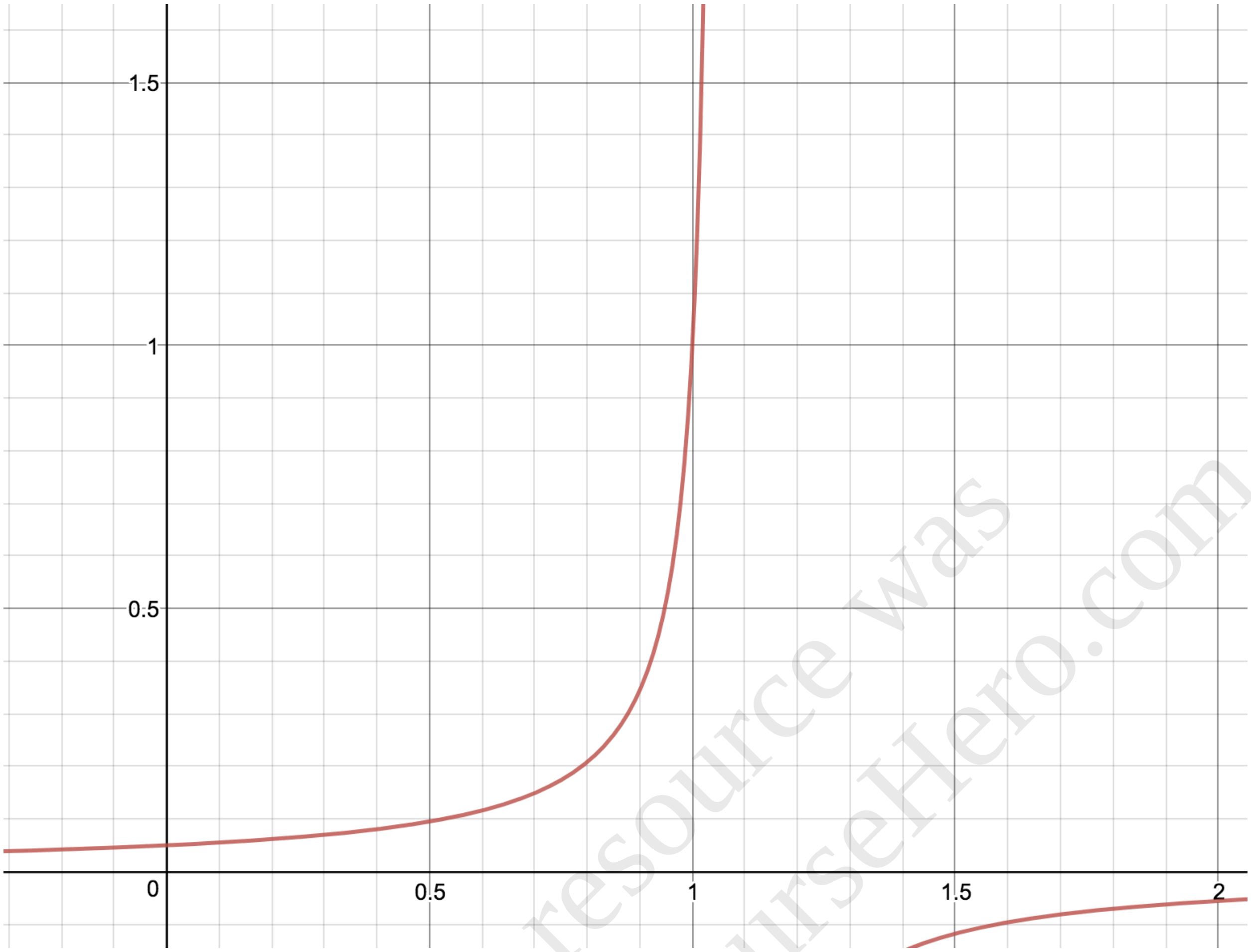
1.7 a. The transistors will stop shrinking by 2021. After this, other methods of improving performance will be researched on. Hence, the moore's law is applicable till 2021 and must be calculated till that year.
No of transistors in 2015 = x
No of transistors in 2025 = $(1.35x)^6$ = $6.05x^6$

b. Performance in 1990 = 24
Increase rate = 52%/year
Performance in 2025 = 24*$(1.52)^{35}$ = 5.55*10^7

EXERCISES

1.10 a. MTTF = 1/FIT = 10^9/100 = **10^7 hours**
b. Module availability = MTTF/(MTTR+MTTF) = 10^7/(24+10^7) = **0.9999976**

1.12 a.



b. Speedup = 1/((1-f)+f/N)

2 = 1/((1-f)+f/20)

f = 0.52

1.12 c. -2 wrong answer See attached solution

c. **0.52**