



JOMO KENYATTA UNIVERSITY OF AGRICULTURE & TECHNOLOGY

SCHOOL OF COMPUTING & INFORMATION TECHNOLOGY

DEPARTMENT OF COMPUTING: BCT 2208 COMPUTER ARCHITECTURE CAT 1 – NOV: 2021

INSTRUCTIONS: ANSWER ALL QUESTIONS

QUESTION 1

Table 1 gives hypothetical relevant chip statistics that influence the cost of several current and future chips. Study it and answer the questions that follow:

Chip	Die Size (mm ²)	Estimated defect rate (per cm ²)	N	Manufacturing size (nm)	Transistors (billion)	Cores
BlueDragon	180	0.03	12	10	7.5	4
RedDragon	120	0.04	14	7	7.5	4
Phoenix ⁸	200	0.04	14	7	12	8

- (a) What is the yield for the Phoenix chip? (3 marks)
- (b) Why does Phoenix have a higher defect rate than BlueDragon (2 marks)
- (c) Assuming that a company produces the above chips for sale. Phoenix is manufactured with the 7nm technology in mind, whereas RedDragon uses the technology used for the 10nm BlueDragon chip. RedDragon will make a profit of USD 15 per defect-free chip and Phoenix \$30 per defect free chip. Each wafer has a 450 mm diameter.
 - i. How much profit will be made from each wafer of Phoenix chips (3 marks)
 - ii. How much profit will be made from each wafer of RedDragon chip (3 marks)

QUESTION 2

- (a) According to the trend in device scaling observed by Moores Law, the number of transistors on a chip in 2025 should be how many times the number in 2015? (2 marks)
- (b) The increase in performance once mirrored the trends in 2(a) above. Had this trend continued, approximately what performance would chips have over VAX-11/780 in 2025? (2 marks)
- (c) At the current rate of increase in performance, what is the more realistic growth projection by 2025 based on recent statistics? (2 marks)
- (d) What has limited the rate of growth of clock speed? (2 marks)
- (e) Discuss key differences between memory hierarchies of a mobile device, PC, and server. Use block diagrams to explain your answer. (9 marks)
- (f) What strategies are used to improve memory hit rates? (2 marks)