



ELIZADE UNIVERSITY

ILARA-MOKIN

FACULTY: BASIC AND APPLIED SCIENCES
DEPARTMENT: MATHEMATICS AND COMPUTER SCIENCE
SECOND SEMESTER EXAMINATION
2015 / 2016 ACADEMIC SESSION

COURSE CODE: CSC 404

COURSE TITLE: Computer Performance Evaluation

COURSE LEADER: Mr. M. K. Aregbesola and Mr. K. Aruleba

DURATION: 2½ Hours

HOD's SIGNATURE

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INSTRUCTION:

Candidates should answer FOUR Questions in all. TWO questions from SECTION A and TWO questions from SECTION B.

Students are warned that possession of any unauthorized materials in an examination is a serious assessment offence.

Students are permitted to use ONLY a non-programmable calculator.

Useful tips:

Using MIPS as a sample metric

$$WHM = \frac{1}{\sum_{i=0}^n \frac{w_i}{MIPS_i}}$$

and

$$WAM = \sum_{i=0}^n w_i \cdot MIPS_i$$

Where w_i is the weight of benchmark i according to instruction count or time (as appropriate). The above equations are equally applicable for other metrics by substituting $MIPS_i$ with the appropriate metric.

SECTION A

Instruction: Answer question 1 and any other question from this section

1. Performance evaluation in computer systems is a very interesting concept which can be classified into two broad categories. Discuss in details with examples. [20 marks]
2. a. What are benchmarks and how are they chosen? Hence, explain the concept of benchmark suites. [3 marks]
b. Speedup is perhaps the single most frequently used metric in the computer architecture community. Considering the benchmark suite in Table 1, where the Total time on the baseline system is 2000 sec and the Total time on the enhanced system is 1800 sec,

Table 1: Sample benchmark suite with 5 benchmarks comparing baseline and enhanced system

Benchmarks	Time on Baseline System	Time on Enhanced System	Individual Speedup
1	500	250	2
2	50	50	1
3	200	50	4
4	1000	1250	0.8
5	250	200	1.25

calculate:

- i. Overall speedup
- ii. The weights of the individual benchmarks for the Baseline System
- iii. The weights of the individual benchmarks for the Enhanced System
- iv. Given the individual speedups in Table 2 and the computed weights in ii and iii above, demonstrate that the overall speedup can equally be

obtained using either Weighted Harmonic Mean (WHM) or Weighted Arithmetic Mean (WAM).

- v. Under what conditions would a Geometric Mean be useful? [7 marks]

3. a. Errors produce noise in measurements, causing a different value to be observed each time a measurement experiment is repeated. Discuss. [4 marks]
- b. What is the role of confidence interval in measurement-based experiments? [3 marks]
- c. The design of experiment techniques can be used to efficiently search a large design space for simulation-based studies. Briefly discuss any one of the most efficient of such techniques. [3 marks]

SECTION B

Instruction: Answer question 4 and any other one from this section

4. a. MIPS is one of the commonly used performance metrics.

$$\text{Given that Overall MIPS} = \frac{\sum_{i=1}^n I_i}{\sum_{i=1}^n t_i}, \text{ for benchmark } i.$$

Prove that the aggregation of the Weighted Harmonic Mean (WHM) weighted with instruction count (IC) and the Weighted Arithmetic Mean (WAM) weighted with time are equivalent to the Overall MIPS. (6 Marks)

- b. Study the benchmark suite in Table 2 below, having total Instruction Count of 2000 million, and overall execution time of 10 seconds, calculate
- i. Overall MIPS
 - ii. Weights of the benchmark with respect to Instruction count
 - iii. Weights of the benchmark with respect to time
 - iv. Weighted Harmonic Mean of Individual MIPS
 - v. Weighted Arithmetic Mean of Individual MIPS
 - vi. Unweighted Harmonic Mean of Individual MIPS
 - vii. Unweighted Arithmetic Mean of Individual MIPS

Table 2: Sample benchmark suite

Benchmarks	Instruction Count (in millions)	Time(sec)	Individual MIPS
1	500	2	250
2	50	1	50
3	200	1	200
4	1000	5	200
5	250	1	250

(14 Marks)

5. With the aid of a diagram, explain event ordering with respect to computer performance & evaluation.

(10 Marks)

6. A. Define the following

- System tuning
- Measurement
- Throughput
- CPU Utilization
- Time
- Response time
- Clock

(7 Marks)

B. List six desirable features that performance modelling/ measurement techniques and tools should possess.

(3 Marks)