

Name:

ID Number (last 4 digits):

Exam Type:

Exam Number:

Grade: 1: ... 2: ... 3: ... 4: ... Total:

THERE ARE 3 (THREE) PAGES TOTAL IN THIS EXAMPAPER

Solve all the problems in 50min in the space provided in this exampaper

Read the Instructions and Problems carefully; do not complain later

Make sure you sign the exam before you turn it in
Unsigned exams are marked with grade 0 (zero).

Signature

NOTE: This exam is closed everything. Only pens/pencils and this exampaper are allowed on the table. For scratch paper, use the rear side of the exam.

WARNING: MOBILE PHONES OR DEVICES PER HANDOUT 1 (SYLLABUS) MUST BE POWERED DOWN AND IN BACKPACK/BAG. OTHERWISE SCREEN FACING THE FLOOR AND ON THE FLOOR (do not step on them!).

Problem 1. (50 POINTS)

Answer briefly or as specified the following questions.

- (1) Give two alternative (alternate) names of (for) the CPU.
- (2) Circle the unsigned integer with the largest magnitude (value).
(a) binary 10000111 , (b) hexadecimal 0x8a, (c) denary 136.
- (3) Four different measures of memory are listed below. Order the measures by writing the numbers 1 through 4 next to them, with 1 representing the smallest and 4 representing the largest measure.
 - 2049KiB
 - 2MiB
 - 1000B
 - 1KiB
- (4) Convert hexadecimal integers $a = 0x32$ and $b = 0x1f$ into denary. Then in denary add them together and calculate the total $c = a + b$ in denary. Finally convert c into binary and give the answer. Also convert c into hexadecimal and show the result correctly.
- (5) State two resources that an Operating System manages.
- (6) Programs and data are stored in the same one memory. What architecture is it? Circle the answer.
Harvard von-Neumann
- (7) Which one of the four numbers is more appropriate to be the size of an L2 cache of a general purpose CPU nowadays? Circle the correct answer.
32KiB 32 1MiB 8GiB
- (8) What do we call a signal or message to the CPU (microprocessor) from some device to indicate that some event has occurred (i.e. the device is seeking to attract the attention of the processor)?
- (9) What are three key characteristics of memory ?
- (10) Why do we need buffers ?

Problem 2. (20 POINTS)

Consider a memory system with a cache and main memory. It takes 20ns to access the cache, and 200ns to access the main memory. If the effective (memory) access time is 15% of the main memory access time, what is the hit ratio H ?

Problem 3. (15 POINTS)

A CPU operates at 2GHz. A job A is CPU-bound (A does computational work) for 10M cycle, and then issues an I/O operation and thus blocks/waits for 20M cycle for the I/O to complete. Job A then resumes its CPU-bound activity for 10M cycle and subsequently terminates. (a) What is the elapsed time of job A in ms? (b) What is the CPU utilization for job A? (Express it as a percentage.)

Problem 4. (15 POINTS)

```
SET MAR $pqrs    # Register MAR set to address pqrs (denary)
SET MAR 0xpqrs   # Register MAR set to address pqrs (hexadecimal)
READ MEM         # Reads from memory ; address specified in MAR
WRIT MEM         # Stores into memory ; address specified in MAR
MOVE AC MBR      # Contents of MBR stored/moved to accumulator AC
ADD AC MBR       # Contents of MBR added to accumulator AC's contents
SET AC $pqrs     # AC is initialized to denary pqrs
ADD AC $pqrs     # AC's contents are added to denary pqrs
HALT             # halts execution
```

An instruction set along the lines of the textbook is shown above; behavior not specified is that described in the textbook. An instruction that does not access memory takes 1cycle. A read or write from memory requires 100cycle. Main memory locations 0x1000 through 0x1009 contain integers denary 1 through denary 10 respectively. (Note also that a memory location of the textbook contains a 16-bit word.) The following two programs Program-A and Program-B get executed; they are displayed side by side. They perform a similar task by adding two integer values, with AC containing the result: one program however uses main memory.

(a) How many cycle does Program-A take to completion? (b) How many cycle does Program-B take to completion? (c) What is the value of AC (in denary) at completion of Program-A?

Program-A	Program-B	Answers
SET MAR 0x1004	SET AC \$4	(a)
READ MEM	ADD AC \$6	
MOV AC MBR	HALT	(b)
SET MAR 0x1006		(c)
READ MEM		
ADD AC MBR		
HALT		