CS/CE 2340
Sample Final Exam

Matching: Select one best choice for the question 1 to 5 .

Sicky bit	Control signal
Structural hazard	Data signal
Round	Scientific notation
Data hazard	Normalized number
Pipeline data hazard	Floating points
Pipelining	Double precision
Guard	Single precision

1- ———————— is the first of two extra bits kept on the right during intermediate calculations of floating- point numbers; used to improve rounding accuracy.

2———————— is an implementation technique in which multiple instructions are overlapped in execution, much like an assembly line.

3- ———————— means that the hardware cannot support the combination of instructions that we want to execute in the same clock cycle.

4 ————————- is a signal used for multiplexer section or for directing the operation of a functional unit

5- ———————— is a notation that renders numbers with a single digit to the left of the decimal point.

6- Calculate ($3.41796875 * 10^{-3} * 6.34765625 * 10^{-3}$) by hand, assuming each of the values are stored in the 16-bit half precision format described in in the textbook. Assume 1 guard, 1 round bit, and 1 sticky bit, and round to the nearest even. Show all the steps, and write your answer in the 16-bit floating point format.

7-Virtual memory use a page table to track the mapping of virtual address to physical addresses. The following data constitutes a stream of virtual addresses as seen on a system. Assume 4KiB pages, a 4-entry fully associative TLB, and true LRU replacement. If pages must be brought in from disk, multiply the next largest page number by two.

4229, 2447, 10756, 35557,44530

Page Table

Valid	Physical Page Number
0	Disk
0	Disk
1	5
1	6
1	9
1	11
0	Disk
1	4
0	Disk
0	Disk
1	3
1	12
1	7
1	8
0	Disk
0	Disk
0	Disk
0	Disk
1	2
0	Disk
1	10
1	14

TLB

Valid	Tag	Physical page number	LRU
1	20	10	0
1	2	5	1
1	3	6	2
0	0	15	3

#LRU as 3 belongs the oldest record in TLB

Given the address stream shown, the initial TLB and page table states provided above, show the final state of the system. Also list for each reference if it is a hit in the TLB, a hit in the page table, or a page fault.

8- Assume there are three small caches, each consisting of four one word blocks. One cache is fully associative, a second is two way set associative, and the third is direct mapped. Find the number of misses for each cache organization given the following sequence of block addresses: 1,7, 6, 5, 1, and 7.

9- consider the following code segment in C:

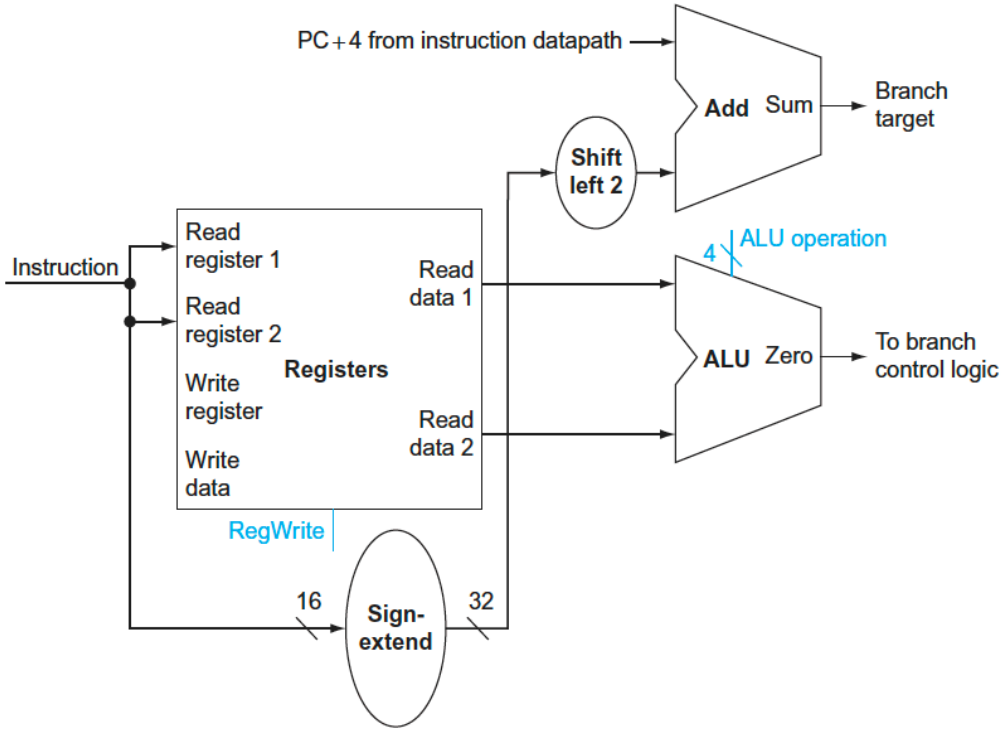
a=b+e;
c=b+f;

Here is the generated MIPS code for this segment, assuming all variables are in memory and are addressable as offsets from $t0

```
lw    $t1, 0($t0)
lw    $t2, 4($t0)
add   $t3, $t1,$t2
sw    $t3, 12($t0)
lw    $t4, 8($t0)
add   $t5, $t1,$t4
sw    $t5, 16($t0)
```

Find the hazards in the preceding code segment and reorder the instructions to avoid any pipeline stalls.

10-Fully explain the following data path for the brach instruction.



11- Show the IEEE 754 binary representation of the number 0.085_{ten} in single and double precision.

12-Translate the following loop into C. Assume that the C-level integer i is held in register $t1, $s2 holds the C-level integer called result, and $s0 holds the base address of the integer MemArray.

```
        addi $t1, $0, 0
LOOP: lw   $s1, 0($s0)
        add  $s2, $s2, $s1
        addi $s0, $s0, 4
        addi $t1, $t1, 1
        slti $t2, $t1, 100
        bne  $t2, $0, LOOP
```