

[Question Type 1: 30 points x 10 questions = 30 points] True/False

- (a) (T ☒ / F ☐) There exists an instruction that can load a 32-bit constant value into a register.
- (b) (T ☒ / F ☐) The heap area of the memory is used for dynamic data structures.
- (c) (T ☐ / F ☒) To process a branch-on-equal (`beq`) instruction, the processor needs to use the data memory.
- (d) (T ☒ / F ☐) A jump and link (`j al`) instruction always writes the PC register with the computed target address.

[Question Type 2: 5 points each x 4 questions = 20 points] Given a MIPS assembly instruction, fill out all the bit positions with 0s and 1s for the corresponding MIPS machine instruction. You need to refer to the MIPS reference card.

```
add $t0, $t1, $t2
```

(MSB)

(LSB)

[illegible]

[Question Type 3: 15 points each x 2 questions = 30 points] Determine the values of the five registers (\$t0, \$t1, \$t2, \$t3, and \$t4) after the following code is executed.

\$t0 () \$t1 () \$t2 () \$t3 () \$t4 ()

```
ori $t0, $zero, 512
slt $t1, $zero, $t0
bne $t1, $zero, L0
ori $t2, $zero, 1024
j L1
L0:
ori $t2, $zero, 2048
L1:
or $t3, $t0, $t2
add $t4, $zero, $zero
L2:
add $t3, $t3, $t0
add $t4, $t4, $t1
slti $t5, $t4, 3
bne $t5, $zero, L2
```

[Question Type 4: 10 points each x 2 questions = 20 points] Determine the values of all the specified control signals (RegDst, MemRead, MemtoReg, ALUSrc, RegWrite) to process `lw $t0, 100($t1)`. If the value of a signal is “don’t care”, you should set “X” to the signal.

RegDst () MemRead () MemtoReg () ALUSrc ()
 RegWrite ()

