COMPITO di *CALCOLATORI ELETTRONICI 1* del 09-07-2012 **MATRICOLA**___________________

COGNOME_____________________

NOME_____________________

1) [20/40] Trovare il codice assembly MIPS corrispondente del seguente programma (**utilizzando solo e unicamente istruzioni dalla tabella sottostante**), **rispettando le convenzioni di utilizzazione dei registri dell'assembly MIPS** (riportate in calce, per riferimento). In alternativa, si usi l'assembly x86 anziche' MIPS.

```
main()
{
   char line[128];
   long lineno = 0;
   int c, except = 0, number =0, found = 0;

   while (--argc > 0 && (*++argv)[0] == ‘-‘)
      while (c = *++argv[0])
         switch (c) {
         case ‘x’:
            except = 1;
            break;
         case ‘n’:
            number = 1;
            break;
         default:
            print_str(“illegal option\n”);
            argc = 0;
            found = -1;
            break;
         }
   if (argc != 1)
      print_str(“wrong usatge\n”);
   else
      while (getline(line, 128) > 0 {
      lineno ++;
      if ((strstr(line, *argv) != NULL) != except) {
         if (number)
            print_int(lineno);
         print_int(line);
         found++;
      }
   exit(0);
}
```

MIPS instructions

Instruction	Example	Meaning	Comments
add	`add $1,$2,$3`	$1 = $2 + $3	3 operands; exception possible
subtract	`sub $1,$2,$3`	$1 = $2 - $3	3 operands; exception possible
add immediate	`addi $1,$2,100`	$1 = $2 + 100	+ constant; exception possible
subtract immediate	`subi $1,$2,100`	$1 = $2 - 100	- constant; exception possible
multiplication	`mult $1, $2`	(HI,LO)= $1 x $2	64-bit Signed Product ; result in HI, LO
division	`div $1, $2`	HI= $1 % $2, LO = $1 / $2	Signed division
move from Hi	`mfhi $1`	$1 = HI	Create copy of HI
move from Lo	`mflo $1`	$1 = LO	Create copy of LO
and	`and $1,$2,$3`	$1 = $2 & $3	3 register operands; Logical AND
or	`or $1,$2,$3`	$1 = $2 | $3	3 register operands; Logical OR
nor	`nor $1,$2,$3`	$1 = !($2 | $3)	3 register operands; Logical NOR
xor	`xor $1,$2,$3`	$1 = $2 ^ $3	3 register operands; Logical XOR
and immediate	`andi $1,$2,100`	$1 = $2 & 100	Logical AND register, constant
or immediate	`ori $1,$2,100`	$1 = $2 | 100	Logical OR register, constant
xor immediate	`xori $1,$2,100`	$1 = $2 ^ 100	Logical XOR register, constant
shift left logical	`sll $1,$2,10`	$1 = $2 << 10	Shift left by constant
shift right logical	`srl $1,$2,10`	$1 = $2 >> 10	Shift right by constant
load word	`lw $1,100($2)`	$1 = Memory[$2+100]	Data from memory to register
load byte	`lb $1,100($2)`	$1 = Memory[$2+100]	Data from memory to register
load byte unsigned	`lbu $1,100($2)`	$1 = Memory[$2+100]	Data from memory to reg.; no sign extension
store word	`sw $1,100($2)`	Memory[$2+100] = $1	Data from register to memory
store byte	`sb $1,100($2)`	Memory[$2+100] = $1	Data from register to memory
load address	`la $1,var`	$1 = &var	Load variable address
branch on equal	`beq $1,$2,100`	if ($1 = = $2) go to PC+4+100	Equal test; PC relative branch
branch on not equal	`bne $1,$2,100`	if ($1 != $2) go to PC+4+100	Not equal test; PC relative
set on less than	`slt $1,$2,$3`	if ($2 < $3) $1 = 1; else $1 = 0	Compare less than; 2`s complement
set on less than immediate	`slti $1,$2,100`	if ($2 < 100) $1 = 1; else $1 = 0	Compare < constant; 2`s complement
set on less than unsigned	`sltu $1,$2,$3`	if ($2 < $3) $1 = 1; else $1 = 0	Compare less than; natural number
set on less than imm. unsigned	`sltiu $1,$2,100`	if ($2 < 100) $1 = 1; else $1 = 0	Compare constant; natural number
jump	`j 10000`	go to 10000	Jump to target address
jump register	`jr $31`	go to $31	For switch, procedure return
jump and link	`jal 10000`	$31 = PC + 4;go to 10000	For procedure call

Register Usage

Name	Register Num.	Usage
$zero	0	The constant value 0
$s0-$s7	16-23	Saved
$t0-$t9	8-15,24-25	Temporaires
$a0-$a3	4-7	Arguments

Name	Register Num.	Usage
$v0-$v1	2-3	Results
$fp, $sp	30,29	frame pointer, stack pointer
$ra, $gp	31,28	return address, global pointer
$k0-$k1	26,27	Kernel usage

Name	Usage
$f0, $f1, … , $f31	Single precision floating point registers
$f0, $f2, … , $f30	Double precision floating point registers

System calls

Service Name	Service Num. ($v0)	INPUT Arguments	OUTPUT Arguments
print_int	1	$a0=integer to print	---
print_float	2	$f12=float to print	---
print_string	4	$a0=address of ASCIIZ string to print	---
sbrk	9	$a0=Number of bytes to be allocated	$v0=pointer to the allocated memory
exit	10	---	---

2) [7/40] Si rappresenti il numero frazionario (base 10) 1.25 secondo lo standard IEEE 754 in singola precisione, illustrando il procedimento per ottenere tale rappresentazione.

3) [13/40] Si consideri una cache di dimensione 1024B e a 8 vie di tipo write-back. La dimensione del blocco e' 64 byte, il tempo di accesso alla cache e' 4 ns e la penalita' in caso di miss e' pari a 40 ns, la politica di rimpiazzamento e' FIFO. Il processore effettua i seguenti accessi in cache, ad indirizzi al byte: 1001, 1205, 1740, 1378, 1492, 1597, 1678, 1712, 1850, 1976, 1025, 1123, 1233, 1377, 1456, 1512, 1613, 1714, 1844, 1911, 2012.
Tali accessi sono alternativamente letture e scritture. Per la sequenza data, ricavare il tempo medio di accesso alla cache, riportare i tag contenuti in cache al termine e la lista dei blocchi (ovvero il loro indirizzo) via via eliminati durante il rimpiazzamento.