Latihan Soal Bahasa Level Mesin – Struktur

1. Diberikan kode C berikut:

```
static int bunny(int l, int r, int *A) {
      int x = A[l]__;
      int i = l-1__;
      int j = r+1__;
      while( _i<j_ ) {
            do j--; while(A[j] > x );
            do i++; while( A[i]<x );
            if( i<j ){
                  int t = A[i];
                  A[i] = A[j];
                  A[j] = t;
            }
      }
      return j;
}
```

Hasil assembly nya adalah sbb:

```
bunny:
      pushl %ebp
      movl %esp, %ebp
      pushl %edi
      pushl %esi
      pushl %ebx
      movl 8(%ebp), %eax     # eax = i = l
      movl 16(%ebp), %esi    # esi = A
      movl (%esi,%eax,4), %edi # edi = x = A[l]
      leal -1(%eax), %ecx    # ecx = i--
      movl 12(%ebp), %ebx     # ebx = r
      incl %ebx               # ebx = j = r++
      cmpl %ebx, %ecx         # i      j
      jge .L3                 #  i >= j jump L3
.L16:
      decl %ebx               # j--
      cmpl %edi, (%esi,%ebx,4)  # A[j]   x
      jg .L16                    #  A[j] > x jump L16
.L7:
      incl %ecx                 # i++
      cmpl %edi, (%esi,%ecx,4) # A[i]     A[l]
      jl .L7                    # A[i]  < x
      cmpl %ebx, %ecx           # i     j
      jge .L3                   # i  >= j jump L3
      movl (%esi,%ecx,4), %edx # edx = A[l]
      movl (%esi,%ebx,4), %eax # eax = A[r]
      movl %eax, (%esi,%ecx,4) # A[l] = eax
      movl %edx, (%esi,%ebx,4) # A[r] = edx
      jmp .L16
.L3:
      movl %ebx, %eax    # return j
      popl %ebx
      popl %esi
      popl %edi
      popl %ebp
ret
```

a. Isilah daftar tabel penggunaan register berikut (gunakan nama variabel pada kode C di atas)

Register	Variabel
%eax	I, A[j], j
%ebx	r, j
%ecx	I
%edx	A[i], t
%esi	A
%edi	X
%esp	Stack pointer
%ebp	Base pointer

b. Lengkapi kode C yang belum terisi

2. Pada kode berikut, M dan N adalah konstanta yang didefinisikan menggunakan #define

```
1   int mat1[M][N];
2   int mat2[N][M];
3
4   int sum_element(int i, int j) {
5       return mat1[i][j] + mat2[j][i];
6   }
```

Hasil kompilasinya adalah sbb:

```
    i at %ebp+8, j at %ebp+12
1     movl    8(%ebp), %ecx
2     movl    12(%ebp), %edx
3     leal    0(,%ecx,8), %eax
4     subl    %ecx, %eax
5     addl    %edx, %eax
6     leal    (%edx,%edx,4), %edx
7     addl    %ecx, %edx
8     movl    mat1(,%eax,4), %eax
9     addl    mat2(,%edx,4), %eax
```

Jelaskan berapakah nilai M dan N

1. #ecx = i
2. edx=j.
3. eax = 8i,
4. eax=8i-i=7i,
5. eax=7i+j.
6. edx = 5j,

7. edx=5j+i.
8. eax = mat1[4*7i+j] + mat2[4*5j+i]

M = 5, N = 7

3. Diberikan kode berikut:

```
int array1[H][J];
int array2[J][H];
void copy_array(int x, int y) {
  array2[y][x] = array1[x][y];
}
```

Jika hasil assembly pada mesin x86-64 adalah sebagai berikut:

```
# On entry:
#       %edi = x
#       %esi = y
#
copy_array:
   movslq %edi,%rdi    # rdi = x
   movslq %esi,%rsi    # rsi = y
   movq %rsi, %rdx     # rdx = y
   salq $4, %rdx       # rdx = 2^4y=16y
   subq %rsi, %rdx     # rdx = 16y - y = 15y
   addq %rdi, %rdx     # rdx = 15y+x
   leaq 0(,%rdi,8), %rax  # rax = 8x
   subq %rdi, %rax     # rax = 8x-x = 7x
   addq %rsi, %rax     # rax = 7x+y
   movl array1(,%rax,4), %eax  # eax = array1[4*7x+y]
   movl %eax, array2(,%rdx,4)  # array2[4*15y+x] = array1[4*7x+y]
   ret
```

Tentukan nilai H dan J.

H = 15, J = 7