

Solution Set 2

Problem 1.

The following program uses the Fortran 90 option to simply write the bit contents of the real number a to the screen:

```

      program rform
c Fortran 90 ouput format
      write(*,*) 'input='
      read (*,*) a
      write(*,1) a
1     format(1x,b32)
      end

```

Rather than using the specific Fortran 90 bit format, ("b32" in the format statement), we may use bit functions to assemble the numbers. Here are three Fortran programs that read the bit representation of the machine you are using for integers, real and real*2 numbers using this technique. Note in particular what happens with the numbers that are transfered to the subroutine in programs two and three. I am here using a 'dirty' trick that sometimes can come in very handy: I am reading real numbers into the subroutine, while inside the subroutine the numbers are treated as integers. The same trick can come in very handy when dealing with complex numbers: Complex numbers can be treated as such on the outside of a subroutine and as vectors of length two on the inside — or vice versa.

Such dirty tricks are very useful, but you need someone to tell you about them. I just did.

Program reading the machine's integer representation.

```

      program heltall
c Integer representation
      dimension in(32)
      write(*,*) 'input='
      read (*,*) ia
      do i=1,32
      in(i)=iand(1,ishft(ia,1-i))
      enddo
      write(*,1) (in(i),i=32,1,-1)
1     format(1x,32(i1))
      end

```

Program reading the machines real number representation.

```

      program realtall
c Real representation
2     continue

```

```

        write(*,*) 'real ='
        read (*,*) a
        call rint(a,b)
        write(*,*) b
        goto 2
    end
c
    subroutine rint(ia,ib)
    dimension in(32)
    do i=1,32
    in(i)=iand(1,ishft(ia,1-i))
    enddo
    write(*,1) (in(i),i=32,1,-1)
1    format(1x,32(i1))
    ib=ia
    return
    end

```

Program reading the machine's real*2 number representation.

```

        program dobbeltall
        double precision a,b
c Real*2 representation
2    continue
        write(*,*) 'Double ='
        read (*,*) a
        call dint(a,b)
        write(*,*) b
        goto 2
    end
c
    subroutine dint(a,b)
    dimension a(2),b(2)
    call rint(a,b)
    return
    end
c
    subroutine rint(ia,ib)
    dimension in(2,32),ia(2),ib(2)
    do j=1,2
    do i=1,32
    in(j,i)=iand(1,ishft(ia(j),1-i))
    enddo
    enddo
    write(*,1) ((in(j,i),i=32,1,-1),j=1,2)
1    format(1x,64(i1))

```

```
ib(1)=ia(1)
ib(2)=ia(2)
return
end
```

Problem 2.

Here is a program measuring the precision of your machine.

```
program presisjon
c Measures machine precision
pres=1.
do i=1,1000
pres=pres*0.5
prp1=1.+pres
if(prp1.le.1.) goto 100
enddo
100 pres=pres*2.
write(*,*) pres
end
```

And, now you can use these programs to find out how your computer stores numbers.