Exercises: Fundamentals of Data Structures (Theory)

(1) Provide a specification for the set of real numbers with operations to add, subtract, multiply, divide, return the negative and compute the factorial.

(2) Compute the running times of the following programs (hint: The rule of thumb given in the lecture does not work here):

```
A. integer pA (arr:integer[])
            sum:integer
            sum:=0
            for i=1 to sqrt(length(arr)) do
                  sum:=sum+1
            for i=1 to log(length(arr)) do
                  sum:=sum+1
            return sum
      endfunc


B. integer pB(arr:integer[])
            sum:integer
            sum:=0
            for i=1 to 10 do
                  sum:=sum+1
                  for j=1 to length(arr) do
                        sum:=sum+1
            return sum
      endfunc


C. integer pC(arr:integer[])
            sum:integer
            sum:=0
            for i=1 to length(arr)*length(arr) do
                  if sum mod 2 = 0 then
                        sum:=sum+1
            return sum
      endfunc


D. integer nsplitarray(arr:integer[])
            pos:integer
            m:integer
            pos:=length(arr)
            m:=0
            while pos > 1 do
                  pos := pos/2
                  m := m+1
            return m
      endfunc
```