

hwk2.R

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# M348 - hwk 2 - feb. 2 2016

# bisection function
# incuts:
#   a: beginning point of interval
#   b: ending point of interval
#   tol: tolerance level of error
#   n: max number of iterations
#   func: function to iterate over
bisection<-function(a,b,tol,n,func){

  # initialize counter
  k<-1

  # create f(a)
  fa<-func(a)

  # while loop to iterate up to n times
  while (k<=n){

    # find c
    c<-(a+b)/2

    # find f(c)
    fc<-func(c)

    # if root found or error within tolerance then output and exit
    if ((fc==0)|((b-a)/2<tol)){

      # vector of outputs
      output<-c(k,c,fc)
      return (output)
    }

    # if fa and fc have the same sign,
    # then set interval to c,b
    if (fa*fc>0){
      a<-c
      fa<-fc
    }

    # if not
    # then set interval to a,c
  }else{
    b<-c
  }
}
```

```

    # print current output
    output<-c(k,c,fc)
    print (output)

    # iterate counter
    k<-k+1
}

# output final result
output<-c(k,c,fc)
return (output)
}

# create input function to be iterated over
f<-function(x){
  return (exp(1)^x - x^2 +3*x -2)
}

# run the bisectional function with:
#   given function f on [0,1]
#   with error limit 1e-08 for 1000 iterations
bisection(0, 1, 1e-08, 1000, f)

```

```

## [1] 1.0000000 0.5000000 0.8987213
## [1] 2.0000000 0.2500000 -0.02847458
## [1] 3.0000000 0.3750000 0.4393664
## [1] 4.0000000 0.3125000 0.2066817
## [1] 5.0000000 0.2812500 0.0894332
## [1] 6.0000000 0.2656250 0.03056423
## [1] 7.0000000 0.25781250 0.001066368
## [1] 8.0000000 0.25390625 -0.01369868
## [1] 9.0000000 0.255859375 -0.006314807
## [1] 10.0000000 0.256835938 -0.002623882
## [1] 11.0000000 0.2573242188 -0.0007786731
## [1] 1.200000e+01 2.575684e-01 1.438683e-04
## [1] 13.0000000000 0.2574462891 -0.0003173971
## [1] 1.400000e+01 2.575073e-01 -8.676307e-05
## [1] 1.500000e+01 2.575378e-01 2.855296e-05
## [1] 1.600000e+01 2.575226e-01 -2.910497e-05
## [1] 1.700000e+01 2.575302e-01 -2.759847e-07
## [1] 1.800000e+01 2.575340e-01 1.413849e-05
## [1] 1.900000e+01 2.575321e-01 6.931256e-06
## [1] 2.000000e+01 2.575312e-01 3.327636e-06
## [1] 2.100000e+01 2.575307e-01 1.525826e-06
## [1] 2.200000e+01 2.575305e-01 6.249205e-07
## [1] 2.300000e+01 2.575303e-01 1.744679e-07
## [1] 2.400000e+01 2.575303e-01 -5.075840e-08
## [1] 2.500000e+01 2.575303e-01 6.185476e-08
## [1] 2.600000e+01 2.575303e-01 5.548180e-09

## [1] 2.700000e+01 2.575303e-01 -2.260511e-08

```