

```
golden <- function(f,lower, upper, tol){
  alpha <- (sqrt(5)-1)/2
  x1 <- alpha * lower + (1-alpha) * upper
  f.x1 <- f(x1)
  x2 <- (1-alpha) * lower + alpha * upper
  f.x2 <- f(x2)
  while(abs(upper - lower) > 2 * tol){
    if (f.x1 < f.x2){
      upper <- x2
      x2 <- x1
      f.x2 <- f.x1
      x1 <- alpha * lower + (1-alpha) * upper
      f.x1 <- f(x1)
    } else {
      lower <- x1
      x1 <- x2
      f.x1 <- f.x2
      x2 <- (1-alpha) * lower + alpha * upper
      f.x2 <- f(x2)
    }
  }
  return((lower + upper) / 2)
}
```