Problem3

November 17, 2016

In [8]:
```
f = x -> cos(x^2)
```

Out[8]: (anonymous function)

In [4]:
```
function midInt(n,f)
    h = (1.0-0)/n
    xsteps = collect(0:h:1)
    mid_int = 0
    for i=2:n
        mid_int += f((xsteps[i]+xsteps[i-1])/2)
    end
    mid_int *= h
    return mid_int
end
```

Out[4]: midInt (generic function with 2 methods)

In [5]:
```
function trapInt(n,f)
    h = (1.0-0)/n
    xsteps = collect(0:h:1)
    trap_int = 0
    for i=2:n
        trap_int += (f(xsteps[i])+f(xsteps[i-1]))
    end
    trap_int *= h/2
    return trap_int
end
```

Out[5]: trapInt (generic function with 2 methods)

In [6]:
```
function simpInt(n,f)
    h = (1.0-0)/n
    xsteps = collect(0:h:1)
    simp_int = 0
    for i=2:n
        simp_int +=  ( f(xsteps[i-1]) + 4*f((xsteps[i-1]+xsteps[i])/2) + f(xsteps[i]) )
    end
    simp_int *= h/6
    return simp_int
end
```

Out[6]: simpInt (generic function with 2 methods)

In [10]:
```
actual = quadgk(f,0,1)[1]
```

Out[10]: 0.904524237900272

```
In [69]: error_mid = abs(mid_int - actual)
         error_trap = abs(trap_int - actual)
         error_simp = abs(simp_int - actual)

         @printf("Method \t\t\t Abs error \t Computation\n")
         @printf("Composite midpoint \t %.8f \t 4n \n", error_mid)
         @printf("Composite trapezoid \t %.8f \t 4n \n", error_trap)
         @printf("Composite Simpson's \t %.8f \t 7n", error_simp)
```

```
Method                          Abs error          Computation
Composite midpoint          0.00054107          4n
Composite trapezoid          0.00054128          4n
Composite Simpson's          0.00054114          7n
```

```
In [ ]: lastE = 7
        mError = zeros(lastE,1)
        tError = zeros(lastE,1)
        sError = zeros(lastE,1)

        @printf("10^x \t Simpsons \t\t\t Trapezoid \t\t\t Midpoint\n")
        for i=1:(lastE)
            mError[i] = abs(midInt(10^(i), f) -actual)
            tError[i] = abs(trapInt(10^(i), f) -actual)
            sError[i] = abs(simpInt(10^(i), f) -actual)

            @printf("%d \t %.16f \t\t %.16f \t\t %.16f \n", i, mError[i],tError[i], sError[i])
        end
```

```
10^x          Simpsons                        Trapezoid                       Midpoint
1          0.0612637202364131              0.0628925177178588              0.0618066527302285
2          0.0054796773363898              0.0055002335204161              0.0054865293977314
3          0.0005410731737462              0.0005412830609605              0.0005411431361522
4          0.0000540379435920              0.0000540400467866              0.0000540386446575
5          0.0000054031002166              0.0000054031212253              0.0000054031072072
6
```

```
In [ ]:
```