Org Mode ConTeXt Export Demo

jasonross1024@gmail.com

(2021-01-07)

Contents

1 Problem 1

Problem   Evaluate numerically the integral

$$I = \int_0^{\pi/2} \ln\left(\sin x\right) dx$$

and compare with the exact value $I = -\frac{\pi}{2}\ln 2$

Solution   …

Note that $\ln\left(\sin x\right) = \ln\left(x\frac{\sin x}{x}\right) = \ln x + \ln \frac{\sin x}{x}$

Therefore we just need to find $\int_0^{\pi/2} \ln x\, dx$ analytically and evaluate $\int_0^{\pi/2} \ln \frac{\sin x}{x} dx$ numerically.

$\int_0^{\pi/2} \ln x\, dx$ can be integrated by parts.

Let $u = \ln x, v' = dx, u' = \frac{1}{x}, v = x$. Therefore,

$$\int lnx dx = \int uv' dx = uv - \int vu' dx$$

$$uv - \int vu' dx = x\ln x - \int x\frac{1}{x}dx = x\ln x - x$$

And so, $\int_0^{\pi/2} \ln x\, dx = x\ln x - x\Big|_0^{\pi/2}$

$$\lim_{x \to 0} x \ln x = \lim_{x \to 0} \frac{\ln x}{\frac{1}{x}}$$

$$= \lim_{x \to 0} -\frac{\frac{1}{x}}{\frac{1}{x^2}}$$

$$= \lim_{x \to 0} -x$$

$$= 0$$

And, $\int_0^{\pi/2} \ln x \, dx = \frac{pi}{2} \left(\ln x - 1 \right) \approx -0.861$

```
1    from sympy import log, pi, integrate
2    from sympy.abc import x
3    print((pi/2 * (log(pi/2) - 1)).evalf())
4    print(integrate(log(x), (x, 0, pi/2)).evalf())
```

```
1    -0.861451872082119
2    -0.861451872082119
```

So we have a value for part of our problem. The other part is to evaluate the integral

$$\int_0^{\pi/2} \ln \frac{\sin x}{x} dx$$

We can do this with Simpson's rule. Recall that

$$S = \frac{H}{9} \sum_{i=0}^{n-1} f(x_0 + iH) + 4f\left(x_0 + \left(i + \frac{1}{2}\right)H\right) + f(x_0 + (i+1)H)$$

```
1    from math import pi, sin, log
2    num_points = 10000
3    xmin = 0
4    xmax = pi/2
5    def f(x):
6        if x == 0:
7            return 0
8        return log(sin(x)/x)
9    H = (xmax - xmin) / num_points
10   def s(x0, i, H, f):
11       return H/6 * (
12           f(x0 + i * H)
13           + 4 * f(x0 + (i + 1/2) * H)
14           + f(x0 + (i + 1) * H)
15       )
16   print(sum(s(xmin, i, H, f) for i in range(num_points)))
```

```
-0.22734117306968255
```

1.1 Sample Subheading

- Item
  Some prose

- Item 2
  Some more prose

Here's some prose in the middle

1. Numbered item

    – A subitem

        ⋆ A subsubitem

2. Another numbered item

Here's some bold *here's some italics* ~~Here's some strikethrough~~
`here's some code` `here's some verbatim` here's some underline!?
Here's some underlined italics
Here's some junk in a drawer

```
1    local function s(a)
2      if control[s] then
3        foo(s)
4      end
5    end
```

```
1    beginfig(1)
2      draw fullcircle scaled 3cm ;
3    endfig ;
4    end ;
```

Here's a link to "**Problem 1**"
Here's a link to **google**
Here's a bare link to **https://orgmode.org**

Thus, I came to the conclusion that the designer of a new system
must not only be the implementer and first large–scale user; the
designer should also write the first user manual.

The separation of any of these four components would have hurt T_EX
significantly. If I had not participated fully in all these activities,
literally hundreds of improvements would never have been made,
because I would never have thought of them or perceived why they
were important.

But a system cannot be successful if it is too strongly influenced
by a single person. Once the initial design is complete and fairly
robust, the real test begins as people with many different viewpoints
undertake their own experiments.

1.1.1 **DONE** Sample SubSubHeading   `sampletag`

Here's a quote from Donald Knuth:

> *The best programs are written so that computing machines can perform them quickly and so that human beings can understand them clearly. A programmer is ideally an essayist who works with traditional aesthetic and literary forms as well as mathematical concepts, to communicate the way that an algorithm works and to convince a reader that the results will be correct.*

1.1.1.1 Sample SubSubSubHeading

Here's a table

Head 1	Head 2
Row 1	Row 2

That was the table

1.1.1.1.1 Sample SubSubSubSubHeading

1.1.1.1.1.1 Sample SubSubSubSubSubHeading