Thesis

An Unserious Study on Batman

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Abstract

Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magnam aliquam quaerat voluptatem. Ut enim aeque doleamus animo, cum corpore dolemus, fieri tamen permagna accessio potest, si aliquod aeternum et infinitum impendere malum nobis opinemur. Quod idem licet transferre in voluptatem, ut postea variari voluptas distinguique possit, augeri amplificarique non possit. At etiam Athenis, ut e patre audiebam facete et urbane Stoicos irridente, statua est in quo a nobis philosophia defensa et collaudata est, cum id, quod maxime placeat, facere possimus, omnis voluptas assumenda est, omnis dolor repellendus. Temporibus autem quibusdam et aut officiis debitis aut rerum necessitatibus saepe eveniet, ut et voluptates repudiandae sint et molestiae non recusandae. Itaque earum rerum defuturum, quas natura non depravata desiderat. Et quem ad me accedis, saluto: 'chaere,' inquam, 'Tite!' lictores, turma omnis chorusque: 'chaere, Tite!' hinc hostis mi Albucius, hinc inimicus. Sed iure Mucius. Ego autem mirari satis non queo unde hoc sit tam insolens domesticarum rerum fastidium. Non est omnino hic docendi locus; sed ita prorsus existimo, neque eum Torquatum, qui hoc primus cognomen invenerit, aut torquem illum hosti detraxisse, ut aliquam ex eo est consecutus? – Laudem et caritatem, quae sunt vitae.. Very bland verbiage here. Will add some interesting stuff once I actually figure out how to write.

Contents

1. Introduction

If you have started reading this document, I have successfully lured you in to read about batman. Spoiler Alert: Batman is awesome, and he cannot be studied because he is AWESOME. Anyways, there are just some sample examples of different usages of some stuff here.

2. Math

To generate the theorem environments below, we use the `ctheorems` package. Here is an sample definition and theorem. One can go through the excellent documentation of the package which has the Manual.

Definition 2.1 (Kolmogorov Smirnov Test):

The one sample Kolmogorov Smirnov test is defined as follows: The empirical distribution function F_n for n independent and identically distributed (i.i.d.) ordered observations X_i is defined as

$$F_n(x) = \frac{\text{number of elements in sample} \leq x}{n} = \left(\frac{1}{n}\right) \sum_{i=1}^{n} I_{[-\infty,x]}(X_i) \tag{2.1}$$

where $I_{[-\infty,x]}(X_i)$ is an indicator function that is 1 if X_i is in the interval $[-\infty, x]$ and 0 otherwise.

The Kolmogorov Smirnov statistic D_n is then defined as

$$D_n = \sup_x |F_{n(x)} - F(x)| \tag{2.2}$$

where F is the cumulative distribution function of the reference distribution being tested against.

Theorem 2.1 (Glivenko-Cantelli Theorem): Suppose that the observations $X_1, X_2, ..., X_n$ used in Definition 2.1 in are independent and identically distributed with cumulative distribution function F. Then, the empirical distribution function F_n converges uniformly to F almost surely, i.e.,

$$\|F_n - F\|_\infty = \sup_{x \in \mathbb{R}} |F_n(x) - F(x)| \longrightarrow 0 \text{ as } n \longrightarrow \infty \tag{2.3}$$

Here is a really interesting paper, where this test was used [1], and the code for generating the same is below.

```typst
#definition("Kolmogorov Smirnov Test")[

  The one sample Kolmogorov Smirnov test is defined as follows:
  The empirical distribution function $F_n$ for n independent and identically distributed (i.i.d.) ordered observations $X_i$ is defined as
  $
    F_n (x) = ("number of elements in sample"<= x)/n = (1/n) sum_(i=1)^n I_([-infty, x])(X_i)
  $
  where $I_([-infty, x])(X_i)$ is an indicator function that is 1 if $X_i$ is in the interval $[-infty, x]$ and 0 otherwise.

  The Kolmogorov Smirnov statistic $D_n$ is then defined as
  $
    D_n = sup_x |F_n(x) - F(x)|
  $
  where $F$ is the cumulative distribution function of the reference distribution being tested against.
]<KStest>
// labelling the definition for later referencing
#theorem("Glivenko-Cantelli Theorem")[
  Suppose that the observations $X_1, X_2, ..., X_n$ used in @KStest in are independent and identically distributed with cumulative distribution function $F$. Then, the empirical distribution function $F_n$ converges uniformly to $F$ almost surely, i.e.,
  $
  norm(F_n - F)_infty = sup_(x in RR) |F_n (x) - F(x)| --> 0 "as" n --> infty
  $
]
```

2.1. Unnumbered Math

A random lagrangian as given by Github Copilot is,

$$\mathcal{L} = -|(\psi)(i\gamma^\mu D_\mu - m)\psi - \left(\frac{1}{4}\right)F_{\mu\nu}F^{\mu\nu} + |D_\mu\varphi|^2 - V(\varphi)$$

where $D_\mu = \partial_\mu + ieA_\mu$ is the covariant derivative, $F_{\mu\nu} = \partial_\mu A_\nu - \partial_\nu A_\mu$ is the electromagnetic field strength tensor, ψ is the Dirac spinor field representing the electron, A_μ is the electromagnetic four-potential, φ is the complex scalar field, and $V(\varphi)$ is the potential energy term for the scalar field.

Below is the code for generating the above lagrangian without equation numbering.

```typst
#nonum($
  cal(L) = -bar(psi)(i gamma^mu D_mu - m)psi - (1/4) F_(mu nu) F^(mu nu) + |D_mu phi|^2 - V(phi)
```

```
3 $)
```

3. Fun CS stuff

Here is some ChatGPT generated Python code that prints the first 10 terms of the Fibonacci sequence:

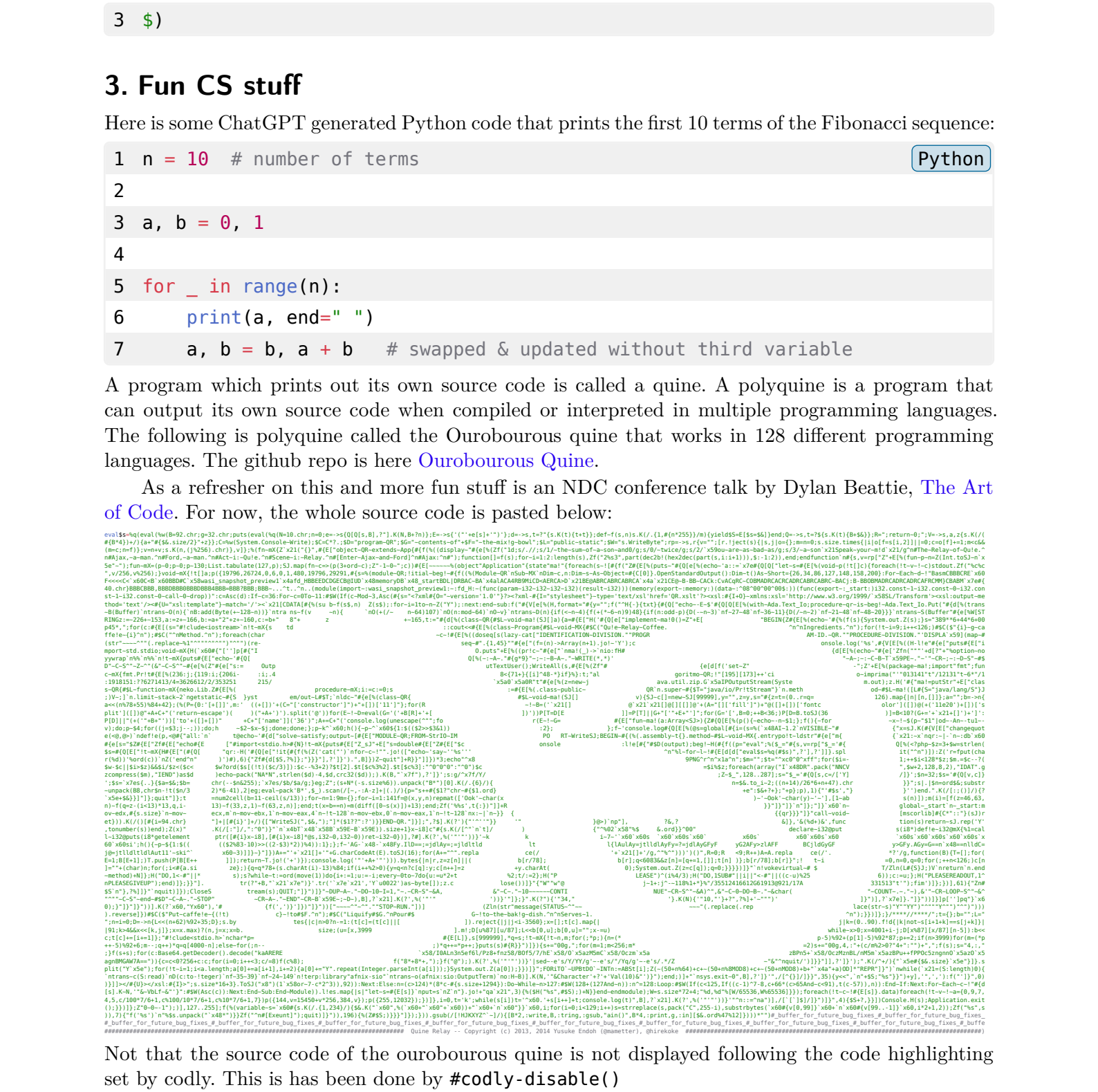
```python
n = 10  # number of terms

a, b = 0, 1

for _ in range(n):
    print(a, end=" ")
    a, b = b, a + b   # swapped & updated without third variable
```

A program which prints out its own source code is called a quine. A polyquine is a polyquine that can output its own source code when compiled or interpreted in multiple programming languages. The following is polyquine called the Ourobourous quine that works in 128 different programming languages. The github repo is here Ourobourous Quine.

As a refresher on this and more fun stuff is an NDC conference talk by Dylan Beattie, The Art of Code. For now, the whole source code is pasted below:



Not that the source code of the ourobourous quine is not displayed following the code highlighting set by codly. This is has been done by `#codly-disable()`

4. Imports

The packages imported for this template are:

1. `ctheorems` for theorem environments.
2. `codly` for code highlighting.
3. `codly-languages` for more language support in codly.
4. `subpar` for creating subfigures easily in typst.

5. `i-figured` for section wise figure numbering.
6. `physica` for physics related symbols and notation.

Proper usage can be found very easily in the typst universe documentations provided by the respective package authors.

5. Conclusion

This is the conclusion as evidenced by Section 5. Batman is still awesome. Anways, here is a joke.

> See, there were these two guys in a lunatic asylum…and one night, one night they decide they don't like living in an asylum any more.
>
> They decide they're going to escape! So, like, they get up onto the roof and there, just across this narrow gap, they see the rooftops of the town, stretching away in the moonlight…stretching away to freedom. Now, the first guy, he jumps right across with no problem. But his friend, his friend daren't make the leap.
>
> Y'see…y'see, he's afraid of falling. So then, the first guy has an idea…
>
> He says 'Hey! I have my flashlight with me! I'll shine it across the gap between the buildings. You can walk along the beam and join me¡
>
> B-but the second guy just shakes his head. He suh-says… he says
>
> 'What do you think I am? Crazy? You'd turn it off when I was half way across!
>
> — Alan Moore

Appendix

lol Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magnam aliquam quaerat voluptatem. Ut enim aeque doleamus animo, cum corpore dolemus, fieri tamen permagna accessio potest, si aliquod aeternum et infinitum impendere malum nobis opinemur. Quod idem licet transferre in voluptatem, ut postea variari voluptas distinguique possit, augeri amplificarique non possit. At etiam Athenis, ut e patre audiebam facete et urbane Stoicos irridente, statua est in quo a nobis philosophia defensa et collaudata est, cum id, quod maxime placeat, facere possimus, omnis voluptas assumenda est, omnis dolor repellendus. Temporibus autem quibusdam et aut officiis debitis aut rerum necessitatibus saepe eveniet, ut et voluptates repudiandae sint et molestiae non recusandae. Itaque earum rerum defuturum, quas natura non depravata desiderat. Et quem ad me accedis, saluto: 'chaere,' inquam, 'Tite!' lictores, turma omnis chorusque: 'chaere, Tite!' hinc hostis mi Albucius, hinc inimicus. Sed iure Mucius. Ego autem mirari satis non queo unde hoc sit tam insolens domesticarum rerum fastidium. Non est omnino hic docendi locus; sed ita prorsus existimo, neque eum Torquatum, qui hoc primus cognomen invenerit, aut torquem illum hosti detraxisse, ut aliquam ex eo est consecutus? – Laudem et caritatem, quae sunt vitae sine metu degendae praesidia firmissima. – Filium morte multavit. – Si sine causa, nollem me ab eo delectari, quod ista Platonis, Aristoteli, Theophrasti orationis ornamenta neglexerit. Nam illud quidem physici, credere aliquid esse minimum, quod profecto numquam putavisset, si a Polyaeno, familiari suo, geometrica discere maluisset quam illum etiam ipsum dedocere. Sol Democrito magnus videtur, quippe homini erudito in geometriaque perfecto, huic pedalis fortasse; tantum enim esse omnino in nostris poetis aut inertissimae segnitiae est aut fastidii delicatissimi. Mihi quidem videtur, inermis ac nudus est. Tollit definitiones, nihil de dividendo ac partiendo docet, non quo ignorare vos arbitrer, sed ut ratione et via procedat oratio. Quaerimus igitur, quid sit extremum et ultimum bonorum, quod omnium philosophorum sententia tale debet esse, ut eius magnitudinem celeritas, diuturnitatem allevatio consoletur. Ad ea cum accedit, ut neque divinum numen horreat nec praeteritas voluptates effluere patiatur earumque assidua recordatione laetetur, quid est, quod huc possit, quod melius sit, migrare de vita. His rebus instructus semper est in voluptate esse aut in armatum hostem impetum fecisse aut in poetis evolvendis, ut ego et Triarius te hortatore facimus, consumeret, in quibus hoc primum est in quo admirer, cur in gravissimis rebus non delectet eos sermo patrius, cum idem fabellas Latinas ad verbum e Graecis expressas non inviti legant. Quis enim tam inimicus paene nomini Romano est, qui Ennii Medeam aut Antiopam Pacuvii spernat aut reiciat, quod se isdem Euripidis fabulis delectari dicat, Latinas litteras oderit? Synephebos ego, inquit, potius Caecilii aut Andriam Terentii quam utramque Menandri legam? A quibus tantum dissentio, ut, cum Sophocles vel optime scripserit Electram, tamen male conversam Atilii mihi legendam putem, de quo Lucilius: 'ferreum scriptorem', verum, opinor, scriptorem tamen, ut legendus sit. Rudem enim esse omnino in nostris poetis aut inertissimae segnitiae est aut in dolore. Omnis autem privatione doloris putat Epicurus terminari summam voluptatem, ut postea variari voluptas distinguique possit, augeri amplificarique non possit. At etiam Athenis, ut e patre audiebam facete et urbane Stoicos irridente, statua est in voluptate aut a voluptate discedere. Nam cum ignoratione rerum bonarum et malarum maxime hominum vita vexetur, ob eumque errorem et voluptatibus maximis saepe priventur et durissimis animi doloribus torqueantur, sapientia est adhibenda, quae et terroribus cupiditatibusque detractis et omnium falsarum opinionum temeritate derepta certissimam se nobis ducem praebeat ad voluptatem. Sapientia enim est una, quae maestitiam pellat ex animis, quae nos exhorrescere metu non sinat. Qua praeceptrice in tranquillitate vivi potest omnium cupiditatum ardore restincto. Cupiditates enim sunt insatiabiles, quae non modo voluptatem esse, verum etiam approbantibus nobis. Sic enim ab Epicuro reprehensa et correcta permulta. Nunc dicam de voluptate, nihil scilicet novi, ea tamen, quae te ipsum probaturum esse confidam. Certe, inquam, pertinax non ero tibique, si mihi probabis ea, quae dicta sunt ab iis quos probamus, eisque nostrum iudicium et nostrum scribendi ordinem adiungimus, quid habent, cur Graeca anteponant iis.

References

[1] N. Neave, K. McCarty, J. Freynik, N. Caplan, J. Hönekopp, and B. Fink, "Male dance moves that catch a woman's eye," *Biology Letters*, vol. 7, no. 2, pp. 221–224, Sept. 2010, doi: 10.1098/rsbl.2010.0619.