

Astroinformatics

— About this course —

Kinoshita Daisuke

Institute of Astronomy, National Central University

11 September 2023

Outline

1. Overview of the course
2. How to execute Python scripts?
3. Recommended books
4. Are you new to Python programming?
5. Extra activity outside the classroom
6. Classes on 18/Sep and 25/Sep
7. Google Calendar

Astroinformatics

- About this course
 - Semester: first semester of academic year 2023
 - from Sep/2023 to Jan/2024
 - Time: from 09:00 to 11:50 on Monday
 - Classroom: S4-914
 - Instructor: Kinoshita Daisuke
 - Main focus of this course
 - Python programming
 - astronomy
 - Hands-on sessions
 - reading source code of sample Python scripts,
 - executing sample Python scripts and seeing what happens
 - writing your own Python scripts and executing those scripts

Astroinformatics

- Language
 - All the courses offered at Institute of Astronomy are given in English.
 - So, this course is also given in English.
 - English is not my native tongue. If you do not understand what I talk, you can interrupt my talk at any time. Tell me about it.
 - If you have any question, you can ask question either in English or Chinese at any time.

Astroinformatics

- Course web page

“Astroinformatics” course web page

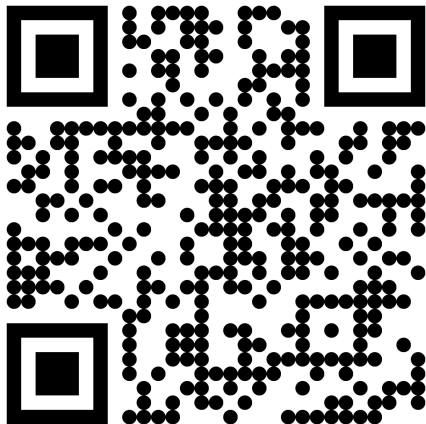
https://s3b.astro.ncu.edu.tw/ai_202309/

- GitHub repository

GitHub repository for the course

https://github.com/kinoshitadaisuke/ncu_astroinformatics_202309

Astroinformatics



https://s3b.astro.ncu.edu.tw/ai_202309/

Astroinformatics



https://github.com/kinoshitadaisuke/ncu_astroinformatics_202309

Grade

- Your grade is evaluated based on
 - attendance (50%)
 - and exercise (50%).
- Attendance: 50%
 - Each week, you submit your response via Google Forms to show your attendance to the class.
 - Each week, you get 50/16 \sim 3.1 points at maximum.
- Exercise: 50%
 - Each week, you try a set of simple exercises.
 - writing Python scripts and showing source code
 - describing important parts of Python scripts
 - executing Python scripts and showing outputs
 - You need to submit your answer sheet within two weeks via Google Forms.
 - Each week, you get 50/16 \sim 3.1 points at maximum.

Attendance check

- 50% of your grade is determined by attendance.
- Each week, a form is provided using Google Forms.
- Fill the form in and submit it before leaving the classroom.
- A link to Google Forms can be found at following web page.

“Astroinformatics” course web page

https://s3b.astro.ncu.edu.tw/ai_202309/

Exercise submission

- 50% of your grade is determined by exercises.
- Each week, a set of exercises is given.
- Make sure to download the problem-set before leaving the classroom.
- You need to submit your answer sheet within two weeks.
 - e.g. Deadline of the exercise submission for the problem-set given on 11/Sep/2023 is 09:00 on 25/Sep/2023.
- Submit your answer sheet via Google Forms.
 - You can find a link to Google Forms at following web page.

“Astroinformatics” course web page

https://s3b.astro.ncu.edu.tw/ai_202309/

Things you bring to the classroom

- Things you need to bring to the classroom
 - computer
 - laptop computer or tablet computer
 - any operating system is fine for this course
 - web browser must be installed on your computer
 - notebook and pens
 - for taking a note
 - mobile phone
 - for taking photos for recording purpose

What do we do in the classroom?

- We write Python scripts and do astronomy.
- What do we do in the classroom?
 - reading sample Python scripts
 - learning important syntax of Python
 - knowing useful modules
 - knowing useful functions
 - knowing useful methods
 - executing sample Python scripts
 - seeing what happens
 - writing your own Python scripts
 - trying number of practices
- Where can we find sample Python scripts for this course?

GitHub repository for the course

https://github.com/kinoshitadaisuke/ncu_astroinformatics_202309

What do we do in the classroom?

- First half of the semester
 - Python programming
 - basics of Python
 - Numpy
 - Scipy
 - Matplotlib
- Second half of the semester
 - Astronomy related topics
 - blackbody radiation
 - distribution of asteroids, stars, and galaxies
 - planetary motion and orbital integration
 - HR diagrams of star clusters
 - Hubble diagram

Course material

- Course material is available for your download at following web page.

Course material

https://s3b.astro.ncu.edu.tw/ai_202309/

- When you come to the classroom on Monday, turn on your computer, start your favourite web browser, and download course material.
- Course material is provided in PDF format.
 - You need to install software for viewing PDF files.
 - e.g. Xpdf, Okular
 - Xpdf: <https://www.xpdfreader.com/>
 - Okular: <https://okular.kde.org/>

Course material

- Some notes for downloading course material
 - Course material can be downloaded only from computers connected to the network of our university.
 - Connect your computer (laptop computer, tablet computer, mobile phone) to one of Wi-Fi of our university.
 - If you are at the classroom, connect to Wi-Fi “IANCU”.
 - If you are outside of our institute, but inside the university, connect to Wi-Fi “NCUWL”.
 - If you are at home, use VPN service of our university.
 - Course material is available for your download for a week.
 - For example, files for the class on 11/Sep/2023 are available for your download until 09:00 on 18/Sep/2023.
 - Make sure to download files when you come to the classroom.
 - Make a directory (folder) on your computer exclusively for this course, and place course material in that directory (folder).
 - Course material is locked by a password.
 - The password to unlock PDF files is shown on the screen in the classroom at 09:00 on Monday.

Wi-Fi “NCUWL”

The screenshot shows the NCUWL website interface. At the top, there is a navigation bar with the NCU logo and the text "國立中央大學 電子計算機中心". To the right of the logo are several menu items: "網站導覽", "服務時間", "表單下載", "常見問題", "訪客", "學生", "教職員", "English". Below the navigation bar is a search icon. The main content area is divided into two columns. The left column has a yellow header "網路服務 Network" and a dark brown sub-header "無線網路". Below this are several menu items: "學生宿網", "教職員宿網", "DNS", "VPN", "Cloud Computing", "Netflow 資料", "10G網路建置", and "雲端運算虛擬主機服務". The right column has a dark brown header "無線網路" and a sub-header "樓內涵蓋範圍". Below this is a table listing various buildings and their wireless network coverage. To the right of the table is a sub-header "室外涵蓋範圍" and another table listing outdoor coverage areas. At the bottom right of the page, there is a green circular logo with the text "LINE" and a small "GetButton" icon.

國立中央大學 電子計算機中心

網路服務 / 無線網路

無線網路

樓內涵蓋範圍

行政大樓各會議室	依仁堂中庭	工一館1F	七餐
舊圖 K 書中心	志希館一樓	土力館1F	九餐
學務處1F	志希館I210會議室	環化館&大講堂	研究生餐廳
游藝館	電算中心大終端機室	工五館A樓1F	管二館餐廳
據德樓	管二館1F&BF	科一~五館1F	松苑餐廳
大講堂&一樓大廳	國鼎館1F	鴻經館&演講廳	女14舍地下室&交誼廳
研一館1F&會議廳	研二館1F&會議廳	電機館	機械館
中大會館	化工系	文一~三館	管理學院
化學系	資工系	網學所	光電大樓
客家學院	圖書館	認知所	

室外涵蓋範圍

太遙中心	環工化工館	大型力學實驗室	籃球場
田徑場	機械館停車場	松苑餐廳	室內 NCUCC 線上客服
依仁堂公車站牌	光電大樓	客家學院	科二館
科五館	工一館	志希館	七餐網廳

<https://www.cc.ncu.edu.tw/page/wireless>

VPN of our university



The screenshot shows a web browser window displaying the VPN help page. The page title is "VPN 服務使用說明". Under the "使用方式" section, there are two steps: Step 1 is to log in and enable VPN service and set a VPN password; Step 2 is to set the VPN password and refer to OS instructions. Below this is a table of IP addresses and authentication methods. Further down, there are sections for authentication methods, VPN service details, and links to OS-specific instructions for Windows 7, 8, 10, Mac OS, and Mobile Devices.

VPN 服務使用說明

使用方式

步驟一、於本系統登入後**啟用VPN服務**並**設定VPN密碼**，請參考下方認證方式說明。

步驟二、設定VPN密碼後，再參考下方各OS說明，並進行相關設定。

IP	Domain	認證對象	認證方式	認證密碼
140.115.197.252	vpn1.ncu.edu.tw	在職職員、在學生(不含休學生)。	portal認證	於本系統設定

認證方式說明

VPN帳號 教職員請使用portal帳號；學生請使用學號。

VPN密碼 請於本系統設定，如何建立VPN密碼

Windows OS

Windows 7 [⇨ 何利用 Windows 7 來連接中央大學 VPN](#)
Windows 7 已於2020年1月14日終止支援

Windows 8 [⇨ 何利用 Windows 8 來連接中央大學 VPN](#)

Windows 10 [⇨ 何利用 Windows 10 來連接中央大學 VPN](#)

Mac OS (支援10.11以上)

macOS v10.12 "Sierra" [⇨ 何利用 macOS 來連接中央大學 VPN](#)

Mobile Device

<https://ncu.edu.tw/VPN/help>

How to execute Python scripts?

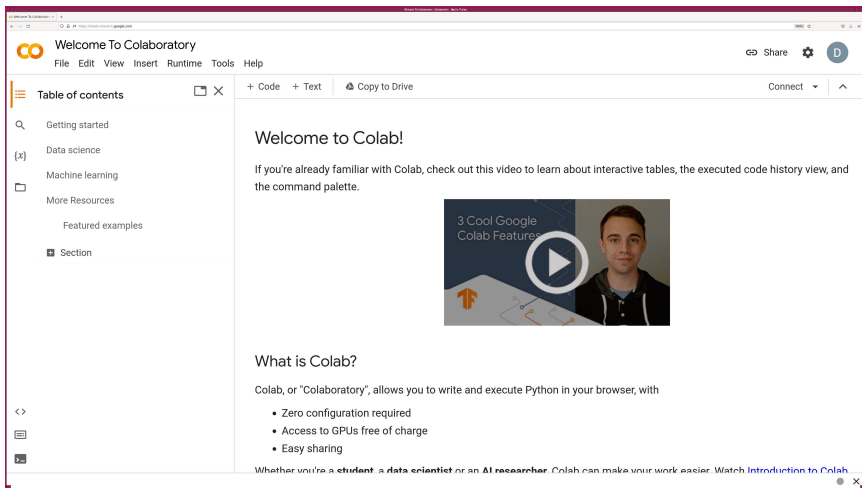
- For this course, we use Google Colaboratory to execute Python scripts.

Google Colaboratory

<https://colab.research.google.com/>

- What you need for using Google Colaboratory?
 - The only thing you need for using Google Colaboratory is a web browser.
 - Install your favourite web browser on your computer.
 - e.g. Firefox, Chrome
- You do not need to install Python on your computer.
 - No Python is needed on your computer.
 - No Numpy is needed on your computer.
 - No Scipy is needed on your computer.
 - No Astropy is needed on your computer.

Google Colaboratory



The screenshot shows the Google Colaboratory web interface. At the top, there is a navigation bar with the Google Colaboratory logo, the text "Welcome To Colaboratory", and a menu with "File", "Edit", "View", "Insert", "Runtime", "Tools", and "Help". On the right side of the navigation bar, there are "Share", "Settings", and a user profile icon. Below the navigation bar, there is a toolbar with "+ Code", "+ Text", and "Copy to Drive" buttons, and a "Connect" button on the right. On the left side, there is a "Table of contents" sidebar with a search icon and a list of items: "Getting started", "Data science", "Machine learning", "More Resources", "Featured examples", and "Section". The main content area displays "Welcome to Colab!" followed by a paragraph: "If you're already familiar with Colab, check out this video to learn about interactive tables, the executed code history view, and the command palette." Below this text is a video player thumbnail with the title "3 Cool Google Colab Features" and a play button icon. Underneath the video player, there is a section titled "What is Colab?" followed by a paragraph: "Colab, or 'Colaboratory', allows you to write and execute Python in your browser, with" and a bulleted list of features: "Zero configuration required", "Access to GPUs free of charge", and "Easy sharing". At the bottom of the main content area, there is a line of text: "Whether you're a student, a data scientist or an AI researcher, Colab can make your work easier. Watch [Introduction to Colab](#)."

<https://colab.research.google.com/>

How to execute Python scripts?

- Method 1 (recommended for this course)
 - Finding a link to a Jupyter Notebook file on Google Drive.
 - Clicking a link and opening a Jupyter Notebook file using Google Colaboratory.
- Method 2
 - Downloading a Jupyter Notebook file from GitHub repository.
 - Opening a Jupyter Notebook file using Google Colaboratory.
- Method 3
 - Downloading a Jupyter Notebook file and a set of Python scripts from GitHub repository.
 - Opening a Jupyter Notebook file using JupyterLab on your computer.
- Method 4
 - Downloading a set of Python scripts from GitHub repository.
 - Executing Python scripts on a terminal emulator on your computer.

Are you new to Python programming?

- If you are new to Python programming, following booklet is recommended for your reading.
 - “The Python Tutorial”

“The Python Tutorial”

<https://docs.python.org/3/tutorial/>

- If you prefer to read Chinese version of “The Python Tutorial”, try following.

“The Python Tutorial” in Chinese

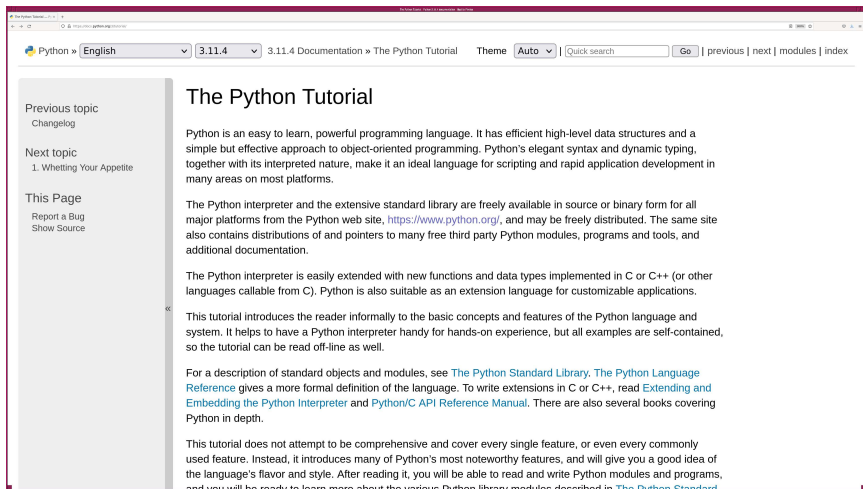
<https://docs.python.org/zh-tw/3/tutorial/>

- If you prefer to download PDF file, visit following page.

A set of PDF files of Python documentation

<https://docs.python.org/3/download.html>

”The Python Tutorial”



The screenshot shows a web browser displaying the Python 3.11.4 documentation page for "The Python Tutorial". The page has a dark blue header with the Python logo, language selection (English), version selection (3.11.4), and navigation links (previous, next, modules, index). The main content area is white with a dark blue sidebar on the left. The sidebar contains links for "Previous topic" (Changelog), "Next topic" (1. Whetting Your Appetite), and "This Page" (Report a Bug, Show Source). The main content area has a large heading "The Python Tutorial" followed by three paragraphs of text. The first paragraph describes Python as an easy-to-learn, powerful programming language. The second paragraph discusses the Python interpreter and the extensive standard library. The third paragraph explains how the Python interpreter is easily extended. The fourth paragraph introduces the tutorial's purpose and structure. The fifth paragraph provides links to the Python Standard Library, Python Language Reference, and other resources. The sixth paragraph describes the tutorial's scope and goals.

Python 3.11.4 Documentation » The Python Tutorial Theme Auto | Quick search Go | previous | next | modules | index

Previous topic

Changelog

Next topic

1. Whetting Your Appetite

This Page

Report a Bug
Show Source

The Python Tutorial

Python is an easy to learn, powerful programming language. It has efficient high-level data structures and a simple but effective approach to object-oriented programming. Python’s elegant syntax and dynamic typing, together with its interpreted nature, make it an ideal language for scripting and rapid application development in many areas on most platforms.

The Python interpreter and the extensive standard library are freely available in source or binary form for all major platforms from the Python web site, <https://www.python.org/>, and may be freely distributed. The same site also contains distributions of and pointers to many free third party Python modules, programs and tools, and additional documentation.

The Python interpreter is easily extended with new functions and data types implemented in C or C++ (or other languages callable from C). Python is also suitable as an extension language for customizable applications.

This tutorial introduces the reader informally to the basic concepts and features of the Python language and system. It helps to have a Python interpreter handy for hands-on experience, but all examples are self-contained, so the tutorial can be read off-line as well.

For a description of standard objects and modules, see [The Python Standard Library](#). [The Python Language Reference](#) gives a more formal definition of the language. To write extensions in C or C++, read [Extending and Embedding the Python Interpreter](#) and [Python/C API Reference Manual](#). There are also several books covering Python in depth.

This tutorial does not attempt to be comprehensive and cover every single feature, or even every commonly used feature. Instead, it introduces many of Python’s most noteworthy features, and will give you a good idea of the language’s flavor and style. After reading it, you will be able to read and write Python modules and programs, and you will be ready to learn more about the various Python library modules described in [The Python Standard](#)

<https://docs.python.org/3/tutorial/>

”The Python Tutorial”

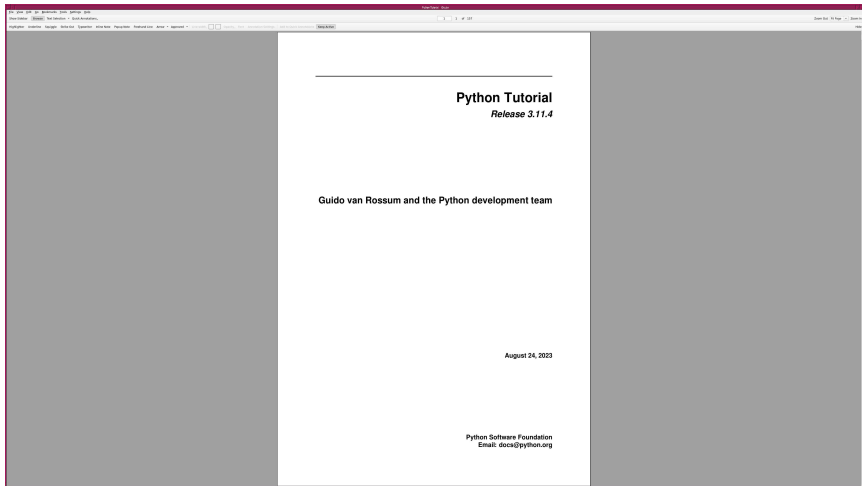


The screenshot shows a web browser displaying the Python 3.11.0 documentation. On the left side, there is a sidebar with navigation links: "Previous topic" (Changelog), "Next topic" (1. Whetting Your Appetite), and "This Page" (Report a Bug, Show Source). The main content area displays a table of contents for the tutorial, organized into four main sections with sub-sections:

- 1. Whetting Your Appetite
- 2. Using the Python Interpreter
 - 2.1. Invoking the Interpreter
 - 2.1.1. Argument Passing
 - 2.1.2. Interactive Mode
 - 2.2. The Interpreter and Its Environment
 - 2.2.1. Source Code Encoding
- 3. An Informal Introduction to Python
 - 3.1. Using Python as a Calculator
 - 3.1.1. Numbers
 - 3.1.2. Text
 - 3.1.3. Lists
 - 3.2. First Steps Towards Programming
- 4. More Control Flow Tools
 - 4.1. `if` Statements
 - 4.2. `for` Statements
 - 4.3. The `range()` Function
 - 4.4. `break` and `continue` Statements, and `else` Clauses on Loops
 - 4.5. `pass` Statements
 - 4.6. `match` Statements
 - 4.7. Defining Functions
 - 4.8. More on Defining Functions
 - 4.8.1. Default Argument Values
 - 4.8.2. Keyword Arguments
 - 4.8.3. Special parameters
 - 4.8.3.1. Positional-or-keyword Arguments
 - 4.8.3.2. Positional-Only Parameters
 - 4.8.3.3. Keyword-Only Arguments
 - 4.8.3.4. Function Examples

<https://docs.python.org/3/tutorial/>

“The Python Tutorial”



“The Python Tutorial” in PDF format (157 pages)

Some more books for your reading

- Here are some more books about introductory Python programming for you.

"Learning Python"

<https://www.oreilly.com/library/view/learning-python-5th/9781449355722/>

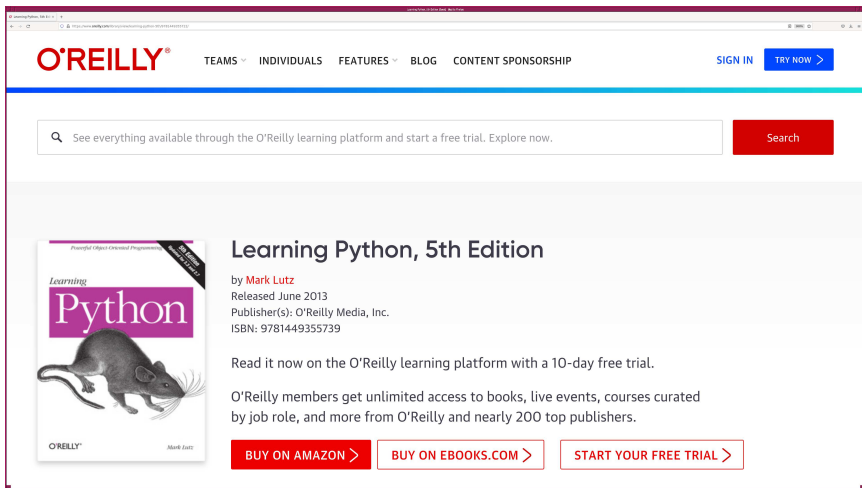
"Programming Python"

<https://www.oreilly.com/library/view/programming-python-second/0596000855/>

"Python Cookbook"

<https://www.oreilly.com/library/view/python-cookbook-3rd/9781449357337/>

“Learning Python”



The screenshot shows the O'Reilly website interface. At the top, the O'Reilly logo is on the left, and navigation links for TEAMS, INDIVIDUALS, FEATURES, BLOG, and CONTENT SPONSORSHIP are in the center. On the right, there are links for SIGN IN and TRY NOW. Below the navigation is a search bar with the placeholder text "See everything available through the O'Reilly learning platform and start a free trial. Explore now." and a red Search button. The main content area features the book cover for "Learning Python, 5th Edition" on the left. The cover is white with a purple band at the top that says "Learning Python" and a black mouse illustration at the bottom. To the right of the cover, the title "Learning Python, 5th Edition" is displayed in a large, bold font. Below the title, the author "by Mark Lutz" is listed, followed by the release date "Released June 2013", the publisher "Publisher(s): O'Reilly Media, Inc.", and the ISBN "ISBN: 9781449355739". A paragraph of text reads: "Read it now on the O'Reilly learning platform with a 10-day free trial." Below this, another paragraph states: "O'Reilly members get unlimited access to books, live events, courses curated by job role, and more from O'Reilly and nearly 200 top publishers." At the bottom of the product section, there are three red buttons: "BUY ON AMAZON >", "BUY ON EBOOKS.COM >", and "START YOUR FREE TRIAL >".

O'REILLY® TEAMS ▾ INDIVIDUALS FEATURES ▾ BLOG CONTENT SPONSORSHIP SIGN IN TRY NOW >

See everything available through the O'Reilly learning platform and start a free trial. Explore now. Search

Learning Python, 5th Edition
by **Mark Lutz**
Released June 2013
Publisher(s): O'Reilly Media, Inc.
ISBN: 9781449355739

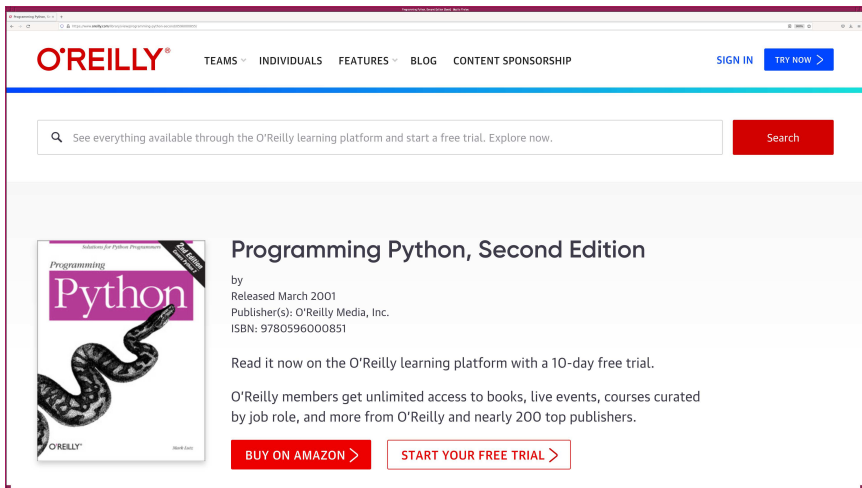
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<https://www.oreilly.com/library/view/learning-python-5th/9781449355722/>

“Programming Python”



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O'REILLY® TEAMS ▾ INDIVIDUALS FEATURES ▾ BLOG CONTENT SPONSORSHIP SIGN IN TRY NOW >

See everything available through the O'Reilly learning platform and start a free trial. Explore now. Search

Programming Python, Second Edition
by
Released March 2001
Publisher(s): O'Reilly Media, Inc.
ISBN: 9780596000851

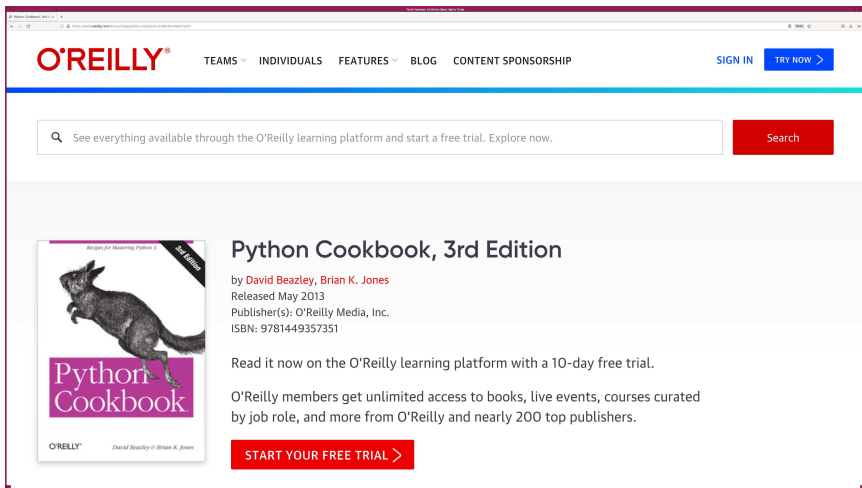
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BUY ON AMAZON > START YOUR FREE TRIAL >

<https://www.oreilly.com/library/view/programming-python-second/0596000855/>

“Python Cookbook”



The screenshot shows the O'Reilly website interface. At the top, the O'Reilly logo is on the left, and navigation links for TEAMS, INDIVIDUALS, FEATURES, BLOG, and CONTENT SPONSORSHIP are in the center. On the right, there are buttons for SIGN IN and TRY NOW. Below the navigation is a search bar with the text "See everything available through the O'Reilly learning platform and start a free trial. Explore now." and a red Search button. The main content area features the book cover for "Python Cookbook, 3rd Edition" on the left. The cover shows a black cat jumping over a purple banner with the text "Python Cookbook". The authors' names, "David Beazley & Brian K. Jones", are at the bottom of the cover. To the right of the cover, the title "Python Cookbook, 3rd Edition" is displayed in a large font. Below the title, the authors' names "by David Beazley, Brian K. Jones" are listed in red. Further down, the release date "Released May 2013", the publisher "Publisher(s): O'Reilly Media, Inc.", and the ISBN "ISBN: 9781449357351" are provided. A paragraph of text reads: "Read it now on the O'Reilly learning platform with a 10-day free trial." Below this, another paragraph states: "O'Reilly members get unlimited access to books, live events, courses curated by job role, and more from O'Reilly and nearly 200 top publishers." At the bottom of the product section is a red button with the text "START YOUR FREE TRIAL >".

O'REILLY® TEAMS ▾ INDIVIDUALS FEATURES ▾ BLOG CONTENT SPONSORSHIP SIGN IN TRY NOW >

See everything available through the O'Reilly learning platform and start a free trial. Explore now. Search

Python Cookbook, 3rd Edition
by **David Beazley, Brian K. Jones**
Released May 2013
Publisher(s): O'Reilly Media, Inc.
ISBN: 9781449357351

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START YOUR FREE TRIAL >

<https://www.oreilly.com/library/view/python-cookbook-3rd/9781449357337/>

Are you new to Python programming?

- Do you need any assistance?
 - If you need a crash course on introductory Python programming, come and talk to me.
 - If any of you need a crash course on introductory Python programming, we may arrange such a crash course.
 - in the classroom or online depending on your preference
 - date/time can be discussed

Programming camp at Lulin Observatory

- Programming camp at Lulin Observatory
 - If any of you is willing to join, we may arrange “Programming Camp” at Lulin Observatory in winter vacation.
 - 3-day or 4-day activity
 - concentrating on programming at Lulin Observatory
 - If you are willing to participate the activity, come and talk to me.
 - If nobody shows interest, then we do not organise the activity.
 - Lulin Observatory

Lulin Observatory

<https://www.lulin.ncu.edu.tw/>

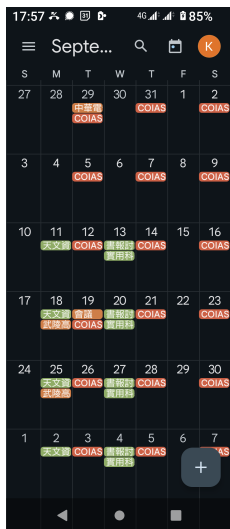
Classes on 18/Sep and 25/Sep

- I need to go to the high school for teaching in the morning on 18 and 25 September 2023.
- Therefore, I need to discuss with you to reschedule classes on 18 and 25 September 2023.
- Is it OK to start classes at 17:00 on 18 and 25 September 2023?
 - from 17:00 to 19:50 on 18/Sep/2023
 - from 17:00 to 19:50 on 25/Sep/2023
- If any of you is not available at 17:00 on 18 and 25 September 2023, then we try to find the other time-slots.

Have a good use of Google Calendar

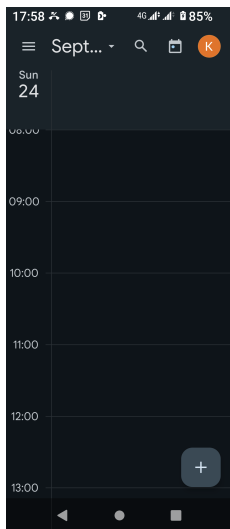
- You need to submit a set of exercises within two weeks.
 - Do not forget the deadline.
- Have a good use of Google Calendar (or something similar).

Making an event on Google Calendar



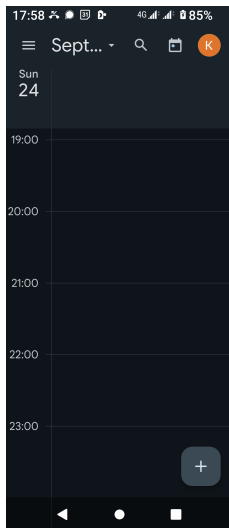
- Tap the icon of Google Calendar on your mobile phone.
- Then, you see a calendar.
- Tap a date on the calendar.

Making an event on Google Calendar



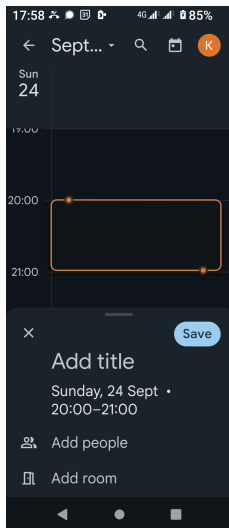
- Now, you see a calendar of a specific date.

Making an event on Google Calendar



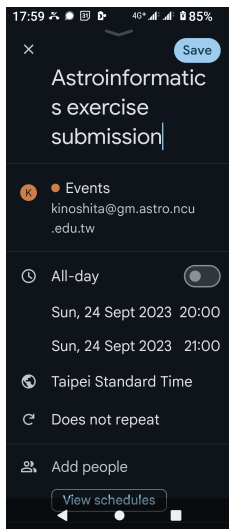
- Scroll down to the time that you would like to make an event.

Making an event on Google Calendar



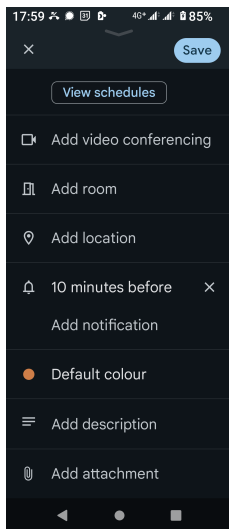
- Tap the time.

Making an event on Google Calendar



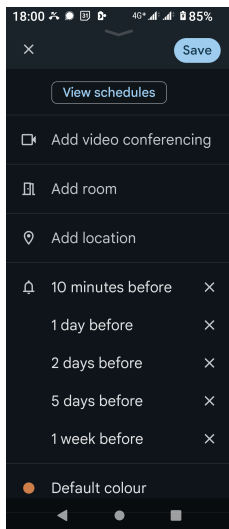
- Type event name.

Making an event on Google Calendar



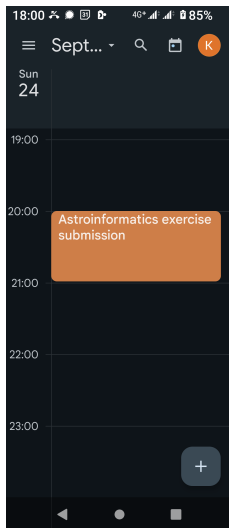
- Scroll down to find the notification setting.

Making an event on Google Calendar



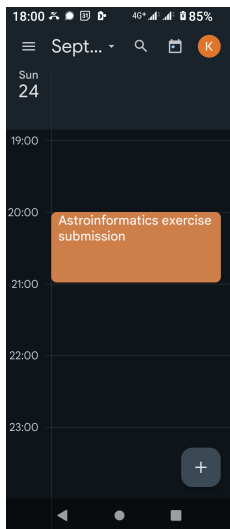
- Set notifications.
- Then, tap the “Save” button.

Making an event on Google Calendar



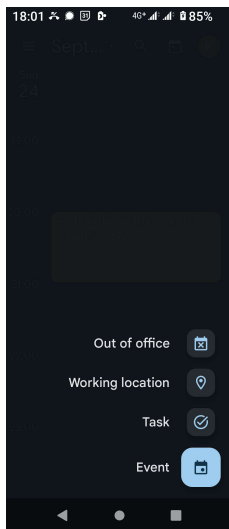
- Now, you have an event.
- You will get notifications and do not forget about the event.

Making a task on Google Calendar



- It is also a good idea to make a task on Google Calendar.
- Tap “+” button.

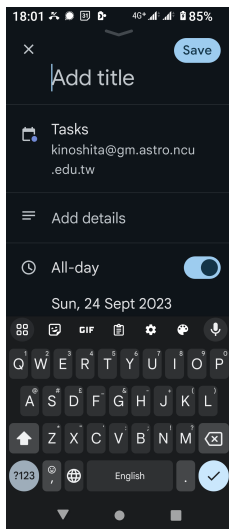
Making a task on Google Calendar



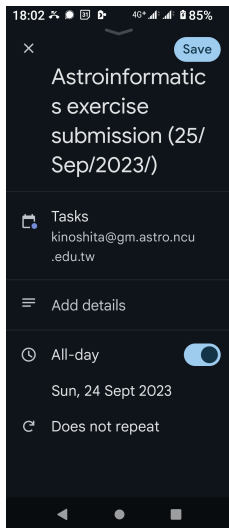
- Tap "Task" icon.

Making a task on Google Calendar

- Now, you can create a new task.

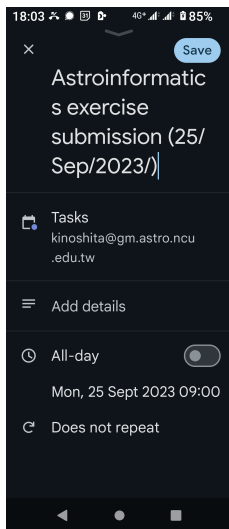


Making a task on Google Calendar



- Type task name.

Making a task on Google Calendar



- Set the time if necessary.
- Then, tap the button "Save".

Enjoy the course!

Enjoy Python programming!

And, enjoy astronomy!