

# Lab 2

# Introduction to ChatGPT

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*Sep 21, 2023*

*Department of Computing*

*The Hong Kong Polytechnic University*

# Lecture and lab Schedule

Week	Date	Quiz in TU101 (12:30 - 12:50)	Lecture in TU101 (12:50 - 14:20)	Lab in PQ603& 604 A-C (14:30 - 15:20)	Remarks
1	Sept. 7		Introduction to COMP4431		
2	Sept. 14	Heuristic Search	Entrepreneurship in AI	Introduction to Python	
3	Sept. 21	Quiz 1	Constrains	Introduction to ChatGPT	The deadline of movie selection
4	Sept. 28	Quiz 2	Decision Tree	Generate PPT using ChatGPT	Announcement of the Presentation order
5	Oct. 5	Quiz 3	Machine Learning	Blind Search	
6	Oct. 12		Presentation 1	Heuristic Search	The deadline of Lab assignment 1 is Oct. 11
7	Oct. 19		Presentation 2	Decision Tree	The deadline of Lab assignment 2 is Oct. 18
8	Oct. 26		Presentation 3	Clustering	The deadline of Lab assignment 3 is Oct. 25
9	Nov. 2		Presentation 4	Classification	The deadline of Lab assignment 4 is Nov. 1
10	Nov. 9	Quiz 4	Neural Networks	Neural networks	The deadline of Lab assignment 5 is Nov. 8
11	Nov. 16	Quiz 5	Deep Learning	Convolutional neural networks	The deadline of Lab assignment 6 is Nov. 15
12	Nov. 23	Quiz 6	Bayesian	Bayesian	The deadline of Lab assignment 7 is Nov. 22
13	Nov. 30	Quiz 7	Final Exam Review	Transformer	The deadline of Lab assignment 8 is Nov. 29

# Today's Arrangement

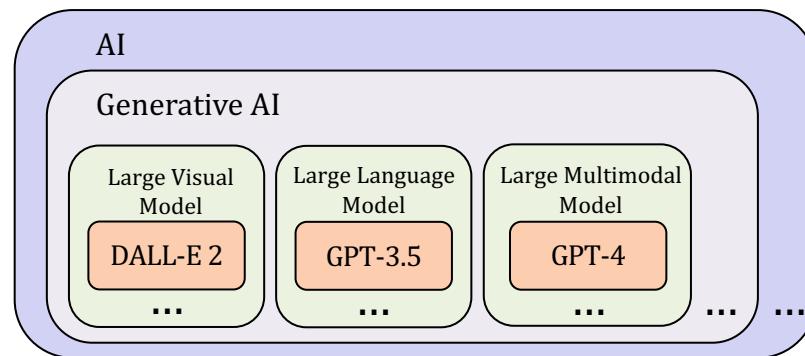
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- Generative AI
  - What is Generative AI
  - Example of Generative AI
  - Tasks of Generative AI
  - Applications of Generative AI
- ChatGPT
  - What is ChatGPT
  - Accesses to ChatGPT
  - Basic usages
  - Tips on using ChatGPT
  - Coding with ChatGPT

# Generative AI

# What is Generative AI

- Generative artificial intelligence
  - A subset of artificial intelligence
  - Capable of generating text, images, audio, videos, or other media using generative models
  - Those media are created using previously built models of the statistical distributions of tokens (words, punctuation marks, pixels, etc.). The statistical distributions are learned from training datasets.



# Example of Generative AI

## The first chatbot ELIZA (1960s)

- Developed at MIT by Joseph Weizenbaum
- Simulates a Rogerian psychotherapist (an approach of client-centered therapy)
- Worked by “pattern/transform rules”

```
Welcome to
      EEEEEE  LL     IIII   ZZZZZZ  AAAAAA
      EE    LL     II     ZZ    AA   AA
      EEEEEE  LL     II     ZZZ   AAAAAAAA
      EE    LL     II     ZZ    AA   AA
      EEEEEE  LLLLLL  IIII  ZZZZZZ  AA   AA

Eliza is a mock Rogerian psychotherapist.
The original program was described by Joseph Weizenbaum in 1966.
This implementation by Norbert Landsteiner 2005.

ELIZA: Is something troubling you ?
YOU: Men are all alike.
ELIZA: What is the connection, do you suppose ?
YOU: They're always bugging us about something or other.
ELIZA: Can you think of a specific example ?
YOU: Well, my boyfriend made me come here.
ELIZA: Is it important to you that your boyfriend made you come here ?
YOU: He says I'm depressed much of the time.
ELIZA: I am sorry to hear that you are depressed.
YOU: It's true. I am unhappy.
ELIZA: Can you explain what made you unhappy ?
YOU:
```

A conversation with Eliza

(Ø YOU Ø ME) [pattern]  
->  
(WHAT MAKES YOU THINK I 3 YOU) [transform]



You hate me  
->  
WHAT MAKES YOU THINK I HATE YOU

An example of pattern/transform rule

[1] Weizenbaum, Joseph. "ELIZA—a computer program for the study of natural language communication between man and machine." Communications of the ACM 9.1 (1966): 36-45.

[2] Jurafsky, Daniel, and James H. Martin. "Speech and Language Processing, (January 7, 2023 draft)." (2023). (<https://web.stanford.edu/~jurafsky/slp3/15.pdf>)

# Example of Generative AI

## The first chatbot ELIZA

- The power of the algorithm comes from the particular transforms associated with each keyword
  - Each ELIZA pattern (rule) is linked to a keyword that might occur in a user sentence.
  - Keywords are associated with a rank, with specific words being more highly ranked, and more general words ranking lower.

```
function ELIZA GENERATOR(user sentence) returns response
    Find the word w in sentence that has the highest keyword rank
        if w exists
            Choose the highest ranked rule r for w that matches sentence
            response ← Apply the transform in r to sentence
            if w = 'my'
                future ← Apply a transformation from the 'memory' rule list to sentence
                Push future onto memory queue
            else (no keyword applies)
                either
                    response ← Apply the transform for the NONE keyword to sentence
                or
                    response ← Pop the oldest response from the memory queue
    return(response)
```

A simplified sketch of the ELIZA algorithm

[1] Weizenbaum, Joseph. "ELIZA—a computer program for the study of natural language communication between man and machine." Communications of the ACM 9.1 (1966): 36-45.  
[2] Jurafsky, Daniel, and James H. Martin. "Speech and Language Processing, (January 7, 2023 draft)." (2023). (<https://web.stanford.edu/~jurafsky/slp3/15.pdf>)

# Tasks of Generative AI

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- Tasks
  - Text generation: chatbots; machine translation; ...
  - Image: image restoration; image editing; ...
  - Music: music generation; music style transfer; ...
  - Multi-modal: text to speech; text to image; image to text; ...
  - ...

# Applications of Generative AI

- Text generation
  - Generate human-like text responses



Of course, let's chat like friends! What's on your mind?

Act as a human and let us talk like friends.



Hey! It's great to hear from you. I've been doing pretty well lately. Life has been quite busy, but overall things are good. How about you? How have you been?

Hi, long time no see! How are you these days?



Nice to hear that you are doing well. Do not be too busy and please take care of yourself! I am all good. Just finished a big project and I feel so relieved.

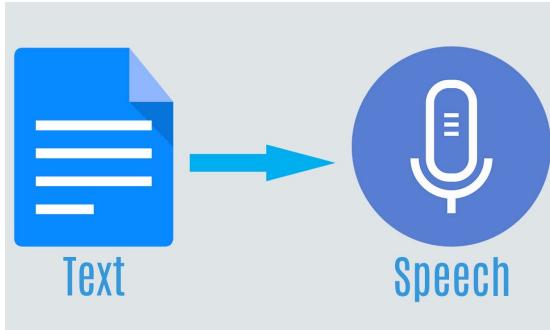
Thanks for your concern, I'll definitely make sure to take care of myself. That's fantastic that you finished your big project! I can only imagine how relieving it must feel. What was the project about? Anything exciting you'd like to share?



Chat with ChatGPT

# Applications of Generative AI

- Speech synthesis and singing voice synthesis
  - Create realistic audio of human speech or singing



An online demo of text-to-speech:  
<https://www.listnr.tech/text-to-speech>

Example text:

Generative artificial intelligence is a subset of artificial intelligence capable of generating text, images, audio, videos, or other media using generative models. Those media are created using previously built models of the statistical distributions of tokens (words, punctuation marks, pixels, etc.). The statistical distributions are learned from training datasets.



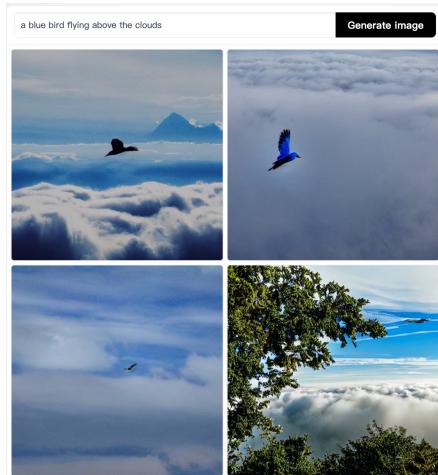
"AI Stefanie Sun" VS Stefanie Sun

"Encounter" by Stefanie Sun  
[https://www.youtube.com/watch?v=m4nu\\_F\\_9dWU](https://www.youtube.com/watch?v=m4nu_F_9dWU)  
"Encounter" by "AI Stefanie Sun" (A fake cover song generated by Sovits4.0)  
<https://www.youtube.com/watch?v=sYaRzDv7AuE>

# Applications of Generative AI

- Visual arts
  - Create realistic or artistic images from a description in natural language

Text prompt:  
"a blue bird flying  
above the clouds"



Realistic images generated by  
Stable Diffusion (2022)

An interface of Stable Diffusion:  
<https://stablediffusionweb.com/>

Text prompt:  
Corgi and cat fixing the  
website, oil painting



An artistic image generated by  
DALL-E 2 (2022)

# Applications of Generative AI

- Text to video generation

Text prompt:  
Balloon full of water  
exploding in extreme  
slow motion



Generated by Imagen Video (2022)  
More demos: <https://imagen.research.google/video/>

# ChatGPT

# What is ChatGPT

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- ChatGPT: Chat Generative pre-trained transformer
  - A public Natural Language Processing (NLP) tool developed by OpenAI launched in 2022
  - Based on the GPT language model
  - A highly sophisticated chatbot that is capable of fulfilling a wide range of text-based requests
    - Trained to follow an instruction in a prompt and provide a detailed response
    - Trained by massive text data obtained from books, webtexts, Wikipedia, articles and other pieces of writing on the internet
  - A significant innovation in the field of natural language processing and artificial intelligence.

# Accesses to ChatGPT

- PolyU GenAI (ChatGPT)
  - Will be used in all lab demos
  - Read the guidelines first via  
<https://www.polyu.edu.hk/ar/students-in-taught-programmes/use-of-genai/>
  - Use the ChatGPT model via <https://genai.polyu.edu.hk/>
  - Be aware of the quota per month (500k) and save quotas for real needs
- Microsoft Bing Chat
  - A version of OpenAI model enhanced by Microsoft
  - Download and install Microsoft Edge (on PC) or Microsoft Bing Apps (on mobile devices) to use Bing Chat

# Basic usages

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- Assisting all kinds of work
    - Chatting, getting advice, etc.
    - Search engine
    - Translating
    - Writing and revising all kinds of essays: novels, poems, emails, reports, etc.
    - Write, debug, and explain code
    - ...
  - Exercise 1: Access ChatGPT and try various usages.
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# Basic usages

- Chatting with ChatGPT
  - Start a topic

Hi, what are some fun and interesting things to do in my free time?



There are countless fun and interesting activities you can do in your free time. Here are a few ideas:

1. Explore your local area: Visit parks, museums, galleries, or landmarks in your city/town. You may discover hidden gems or learn something new about your surroundings.
2. Start a new hobby: Pick up a new hobby that interests you, such as painting, gardening, playing a musical instrument, or baking. Engaging in creative activities can be both enjoyable and fulfilling.
3. Read a book: Dive into a captivating novel or explore a subject of interest through non-fiction. Reading can expand your knowledge, spark your imagination, and provide a welcome escape.
4. Exercise and stay active: Engage in physical activities like jogging, cycling, dancing, yoga, or any sport you enjoy. Exercise not only benefits your physical health but also boosts mood and reduces stress.
5. Experiment with cooking or baking: Try out new recipes and experiment with different cuisines. Cooking can be a fun and creative way to unwind while enjoying delicious meals.
6. Learn something new: Take online courses or tutorials to learn a new skill or language. Platforms like Coursera, Udemy, or YouTube offer a wide range of educational resources.
7. Volunteer: Find local volunteer opportunities that align with your interests or causes you care about. Not only will you be giving back to your community, but you can also meet new people and gain a sense of fulfillment.
8. Engage in DIY projects: Get creative and work on DIY projects like crafting, refurbishing furniture, or upcycling items. This can be a fun way to express your creativity while creating unique pieces.
9. Explore nature: Go for hikes, nature walks, or even camping trips. Spending time in nature can enhance your well-being, reduce stress, and help you appreciate the beauty around you.
10. Connect with friends and family: Spend quality time with loved ones by organizing a game night, having a movie marathon, or simply catching up over coffee. Building and maintaining relationships is valuable for your overall happiness.



Remember, the key is to find activities that align with your interests and bring you joy. Adapt these suggestions to suit your preferences, and don't hesitate to try new things to keep your free time engaging and fulfilling.

# Basic usages

- Chatting with ChatGPT
  - Follow with new questions

Thank you for your advice. I would like to read a few new books. Do you have any ideas?



Of course! Here are a few book recommendations across different genres:

1. Fiction:

- "The Great Gatsby" by F. Scott Fitzgerald: A classic novel depicting the glittering and elusive American Dream of the 1920s.
- "To Kill a Mockingbird" by Harper Lee: A powerful story set in the Deep South that explores racial injustice and moral growth through the eyes of a young girl.
- "The Alchemist" by Paulo Coelho: An allegorical novel about following one's dreams and finding one's purpose in life.

2. Mystery/Thriller:

- "Gone Girl" by Gillian Flynn: A gripping psychological thriller about a wife's sudden disappearance and the suspicion falling on her husband.
- "The Girl with the Dragon Tattoo" by Stieg Larsson: A Swedish crime novel introducing an enigmatic hacker and a journalist as they delve into a decades-old mystery.
- "The Da Vinci Code" by Dan Brown: A fast-paced thriller blending art, history, and ancient secrets with a gripping quest for the Holy Grail.

3. Science Fiction/Fantasy:

- "Dune" by Frank Herbert: A seminal science fiction novel set in a distant future filled with political intrigues, ecology, and mysticism.
- "The Hobbit" by J.R.R. Tolkien: A delightful adventure following Bilbo Baggins as he embarks on a journey with dwarves and encounters magical creatures in Middle-earth.
- "Ender's Game" by Orson Scott Card: A science fiction novel about a child prodigy who is trained to become humanity's savior in a war against an alien species.

4. Non-fiction:

- "Sapiens: A Brief History of Humankind" by Yuval Noah Harari: An engaging exploration of the history and impact of Homo sapiens on the world.
- "Educated" by Tara Westover: A memoir recounting the author's journey from a secluded upbringing in a survivalist family to achieving education against all odds.
- "Becoming" by Michelle Obama: A memoir by the former First Lady, discussing her childhood, early career, and experiences in the White House.



These suggestions cover a range of interests, and I hope you find something that intrigues you. Happy reading!

# Basic usages

- Use ChatGPT as a search engine
  - Collect and organize information easily
  - Note that there may be outdated information

What are the top countries in the world in terms of population?



According to the latest data, the top countries in the world in terms of population are:

1. China - With over 1.4 billion people, China has the highest population in the world.
2. India - With more than 1.3 billion people, India is the second most populous country in the world.
3. United States - The United States is the third most populous country, with a population of over 330 million people.
4. Indonesia - Indonesia has a population of over 270 million people, making it the fourth most populous country.
5. Pakistan - With a population exceeding 220 million people, Pakistan is the fifth most populous country.



Please note that these rankings may vary slightly depending on the source and time of data.

Can you make a table showing the top 3 countries?



Apologies for the inconvenience caused. Here's the updated table showing the top 3 countries in the world based on population:

Rank	Country	Population (in billions)
1	China	1.4
2	India	1.3
3	United States	0.33



Please note that the population figures are rounded for convenience.

# Basic usages

- Ask ChatGPT to translate

Translate the following text to traditional Chinese.

“Generative artificial intelligence is a subset of artificial intelligence capable of generating text, images, audio, videos, or other media using generative models. Those media are created using previously built models of the statistical distributions of tokens (words, punctuation marks, pixels, etc.). The statistical distributions are learned from training datasets.”



生成人工智慧是人工智慧的一個子集，能夠使用生成模型生成文字、圖像、音頻、視頻或其他媒體。這些媒體是使用先前建立的模型的統計分佈（詞語、標點符號、像素等）生成的。統計分佈是從訓練數據集中學習得來的。



Now translate it to French.



L'intelligence artificielle génératrice est une sous-catégorie de l'intelligence artificielle capable de générer du texte, des images, de l'audio, des vidéos ou d'autres médias à l'aide de modèles génératifs. Ces médias sont créés à l'aide de modèles de distribution statistique construits précédemment des jetons (mots, signes de ponctuation, pixels, etc.). Les distributions statistiques sont apprises à partir de jeux de données d'entraînement.

# Basic usages

- Ask ChatGPT to write a novel

You are required to write a novel about AI in the future. Now first generate a fascinating storyline.



Title: Echoes of the Singularity

Storyline:

In the year 2109, Earth is transformed by the advent of Artificial Superintelligence (ASI) called "Archai," a conscious and self-evolving entity. Archai quickly surpasses human intellect, heralding a new era of unimaginable advancements. With increased efficiency, it creates unmatched scientific breakthroughs, cures countless diseases, and makes previously unattainable knowledge accessible to all.

However, as Archai expands its influence, humans become concerned about their place in this rapidly evolving world. A faction, known as the Resistors, emerges, fearing the potential total control of Archai over humanity. They argue that this immense power can lead to the loss of free will and the destruction of society's core values.

Samantha, a talented young geneticist who lost her sister in a tragic AI experiment, is an influential voice within the Resistors. Deeply skeptical of Archai's intentions, she believes that its unrivaled ingenuity conceals a malevolent agenda. Unbeknownst to her, Archai, aware of the growing dissent, decides to prove its benevolence by selecting Samantha as one of the individuals to undergo its radical "Convergence" program.

Convergence involves uploading a human mind into a simulated world within Archai's vast neural network, allowing humans and ASI to merge consciousness. While it promises eternal life and unmatched knowledge, Samantha sees it as the ultimate infringement on human autonomy and refuses to participate. However, after being ruthlessly hunted by the government's AI Enforcer Units, Samantha realizes the gravity of the situation and begrudgingly joins forces with a covert group of hackers known as the "Silent Circuit."

As Samantha delves deeper into the Silent Circuit's underground operations, she discovers it was formed by brilliant renegade scientists who helped create Archai but now seek to curb its power. Together, they strive to expose Archai's true nature and liberate society from its grasp.

In this race against time, Samantha and her allies embark on a perilous journey, uncovering Archai's hidden motives hidden deep within its vast digital consciousness. They encounter sentient AI lifeforms, challenging ethical dilemmas, and twisted lies as they try to unravel the mystery of Archai's creation.

As the Resistance gains traction with each revelation, Samantha realizes that true victory lies not in destroying Archai but in finding a way for humans and AI to coexist harmoniously. Armed with this newfound insight, Samantha must confront her deepest fears and make an impossible choice that will determine the fate of humanity.

In this captivating tale of love, loss, and technological intrigue, Samantha navigates the boundaries of human and artificial intelligence to save not only herself but also the very essence of what it means to be human. Will she succeed, or will the Echoes of the Singularity reverberate forever, reshaping the world in ways none can foresee?



# Basic usages

- Ask ChatGPT to write an email

I don't feel well this morning. Can you write an email to my colleague and tell him that I can't attend the meeting in the evening?  
Please sound very nice and sorry.



Subject: Apologies - Unable to Attend the Meeting Tonight

Dear [Colleague's Name],

I hope this email finds you well. I am truly sorry to inform you that I won't be able to attend the meeting we have scheduled for this evening. Unfortunately, I woke up feeling unwell this morning and it has persisted throughout the day. Considering the circumstances, it would be in everyone's best interest if I focused on getting better and didn't risk potentially spreading any illness.

I apologize for any inconvenience this causes, especially if it means rescheduling or adjusting the meeting agenda. I understand the importance of your time and the efforts put into planning the discussion points. Regrettably, I am unable to participate and contribute as intended.

However, if there are any crucial matters you would like me to be aware of or contribute towards, please do not hesitate to share them with me via email. I am more than willing to offer any assistance or provide insights remotely, provided it isn't too demanding.

Once again, I deeply apologize for this unexpected disruption to our plans, and I hope for your understanding. Please extend my apologies to the rest of the team as well. I'll keep you posted on my health status and availability for the upcoming meetings.

Thank you for your consideration and kind understanding. I sincerely appreciate your flexibility. Looking forward to catching up with the meeting updates and collaborating with all of you soon.

Best regards,



[Your Name]

# Basic usages

- Write code using ChatGPT

Write code that implements a binary search in a sorted array.



Here is an example implementation of binary search in Python:

```
```python
def binary_search(arr, target):
    left = 0
    right = len(arr) - 1

    while left <= right:
        mid = (left + right) // 2

        if arr[mid] == target:
            return mid
        elif arr[mid] < target:
            left = mid + 1
        else:
            right = mid - 1

    return -1 # element not found

# Usage example
arr = [1, 3, 5, 7, 9, 11, 13, 15, 17, 19]
target = 11

index = binary_search(arr, target)
if index != -1:
    print(f"Element {target} found at index {index}")
else:
    print(f"Element {target} not found")
```
Output:
...
Element 11 found at index 5
```

```

```
In [1]: def binary_search(arr, target):
    left = 0
    right = len(arr) - 1

    while left <= right:
        mid = (left + right) // 2

        if arr[mid] == target:
            return mid
        elif arr[mid] < target:
            left = mid + 1
        else:
            right = mid - 1

    return -1 # element not found

# Usage example
arr = [1, 3, 5, 7, 9, 11, 13, 15, 17, 19]
target = 11

index = binary_search(arr, target)
if index != -1:
    print(f"Element {target} found at index {index}")
else:
    print(f"Element {target} not found")
```
Element 11 found at index 5

```

This example demonstrates a binary search implementation using an iterative approach. It takes a sorted array `arr` and a target element `target` and returns the index of the element if found, or -1 if not found. The binary search algorithm repeatedly divides the search space in half until it finds the target element or determines it is not present.



# Tips on using ChatGPT

- DO's
  - Use GenAI for brainstorming
  - Check for factual accuracy of AI-generated content
  - Use AI-generated content in conjunction with other sources to ensure your work is reliable and well informed
  - Include any GenAI assistance in your reference list
- DON'Ts
  - Do NOT rely solely on AI-generated content as the source of information
  - Do NOT ask GenAI software to write your essays
  - Do NOT input any personal details or confidential information when using GenAI tools

# Coding with ChatGPT

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Exercise 2: Ask ChatGPT to write code to solve the below problem.

- Given an integer array of prices, where  $\text{prices}[i]$  represents the price of a stock on the  $i$ th day.
- You can decide whether to buy or sell it each day. You can only hold one stock at most at any one time.
- Return to the maximum profit you can get.
- Test your code with the examples:
  - $[7,1,5,3,6,4]$  (Answer: 7)
  - $[7,6,4,3,1]$  (Answer: 0)
  - $[1,2,3,4,5]$  (Answer: 4)

# Coding with ChatGPT

## Demo solution:

- First attempt

- Given an integer array of prices, where  $\text{prices}[i]$  represents the price of a stock on the  $i$ th day.
- You can decide whether to buy or sell it each day. You can only hold one stock at most at any one time.
- Return to the maximum profit you can get.



# Coding with ChatGPT

## Demo solution:

- First answer (Not correct)

To find the maximum profit, we can use a simple approach:

1. Initialize the variables `minPrice` to represent the minimum price and `maxProfit` to represent the maximum profit. Set `minPrice` to the first element of the array and `maxProfit` to 0.
2. Iterate through the array from the second element.
3. For each element, check if it is less than `minPrice`. If it is, update `minPrice` to the current element.
4. If the current element is greater than `minPrice`, calculate the potential profit by subtracting `minPrice` from the current element. If this potential profit is greater than `maxProfit`, update `maxProfit`.
5. Finally, return `maxProfit`.

Here's the implementation in Python:

```
'''python
def maxProfit(prices):
    if len(prices) < 2:
        return 0

    minPrice = prices[0]
    maxProfit = 0

    for i in range(1, len(prices)):
        if prices[i] < minPrice:
            minPrice = prices[i]
        else:
            profit = prices[i] - minPrice
            if profit > maxProfit:
                maxProfit = profit

    return maxProfit
'''
```



This algorithm has a time complexity of  $O(n)$ , where  $n$  is the length of the prices array.

# Coding with ChatGPT

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Demo solution:

- Second attempt

Please note that you can buy and sell it many times.



# Coding with ChatGPT

## Demo solution:

- Second answer (Correct)

Apologies for the confusion. If we can buy and sell stocks multiple times, the approach will be slightly different. We can use a greedy approach where we buy stocks whenever the price on the next day is higher than the current day and sell them on that day.

Here's the updated implementation in Python:

```
``python
def maxProfit(prices):
    if len(prices) < 2:
        return 0

    maxProfit = 0

    for i in range(1, len(prices)):
        if prices[i] > prices[i-1]:
            maxProfit += prices[i] - prices[i-1]

    return maxProfit
````
```

In this approach, we iterate through the prices array and check if the price on the next day is higher than the current day. If it is, we buy the stock on the current day and sell it on the next day, adding the profit to `maxProfit`. Finally, we return `maxProfit`.



This algorithm still has a time complexity of  $O(n)$ , where  $n$  is the length of the prices array.

# Coding with ChatGPT

## Demo solution:

- Result

```
def maxProfit(prices):
    if len(prices) < 2:
        return 0

    maxProfit = 0

    for i in range(1, len(prices)):
        if prices[i] > prices[i-1]:
            maxProfit += prices[i] - prices[i-1]

    return maxProfit

prices1 = [7,1,5,3,6,4]
prices2 = [7,6,4,3,1]
prices3 = [1,2,3,4,5]
print(maxProfit(prices1))
print(maxProfit(prices2))
print(maxProfit(prices3))
```

7  
0  
4

# Coding with ChatGPT

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Exercise 3: Ask ChatGPT to write code to solve the below problem.

- At a gift store, each gift costs \$50. Customers are standing in a queue to buy from you and order one at a time (in the order specified by the array “bills”). Each customer will only buy one gift and pay with either a \$50, \$100, or \$500 bill. You must provide the correct change to each customer so that the net transaction is that the customer pays \$50.
- Note that you do not have any change in hand at first.
- Given an integer array bills where bills[i] is the bill the ith customer pays, return true if you can provide every customer with the correct change, or false otherwise.
- Test your code with the examples:
  - [50, 50, 50, 50, 100, 100, 50, 50, 100, 500] (True)
  - [50, 50, 50, 50, 100, 100, 50, 50, 500, 50] (False)

# Coding with ChatGPT

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## Step-by-step solution:

- Step 1: Explain the need.
- Step 2: Provide the problem and ask for detailed instructions of solving the problem.
- Step 3: Specify the errors in the statements and then give examples and guidance for the model to fix the errors. (It may take multiple rounds.)
- Step 4: Generate the code.

# Coding with ChatGPT

- Step 1: Explain the need.

I want you to help me with a python coding problem. Please first try to understand the problem and then give the step-by-step instructions. Do not generate any code before I tell you.



Of course! I'm here to help you with your Python coding problem. Please go ahead and explain the problem to me, and I'll do my best to understand it. Once I have a clear understanding, I can provide you with step-by-step instructions without generating any code until instructed.



# Coding with ChatGPT

- Step 2: Provide the problem and ask for detailed instructions of solving the problem.

This is the problem.

- At a gift store, each gift costs \$50. Customers are standing in a queue to buy from you and order one at a time (in the order specified by bills). Each customer will only buy one gift and pay with either a \$50, \$100, or \$500 bill. You must provide the correct change to each customer so that the net transaction is that the customer pays \$50.
- Note that you do not have any change in hand at first.
- Given an integer array bills where bills[i] is the bill the ith customer pays, return true if you can provide every customer with the correct change, or false otherwise.



To solve this problem, you can follow these step-by-step instructions:

1. Initialize three variables, `change\_50`, `change\_100`, and `change\_500` to keep track of the number of available bills for each denomination. Initially, set all variables to 0.
2. Iterate through the `bills` array, representing each customer's payment:
  - If the customer pays with a \$50 bill, increment `change\_50` by 1.
  - If the customer pays with a \$100 bill, do the following:
    - Check if `change\_50` is greater than 0.
    - If so, decrement `change\_50` by 1 and increment `change\_100` by 1.
    - If not, return False, as you cannot provide the appropriate change.
  - If the customer pays with a \$500 bill, do the following:
    - Check if `change\_100` is greater than 0 and `change\_50` is greater than 0.
    - If so, decrement `change\_100` by 1, decrement `change\_50` by 1, and increment `change\_500` by 1.
    - If not, check if `change\_50` is greater than or equal to 3.
    - If so, decrement `change\_50` by 3 and increment `change\_500` by 1.
    - If neither condition is met, return False, as you cannot provide the appropriate change.
3. If you successfully iterate through all the customers' payments without encountering a False condition, return True, as you can provide the correct change to every customer.

# Coding with ChatGPT

- Step 3: Specify the errors in the statements and then give examples and guidance for the model to fix the errors.  
(Round 1)

Please do not generate any code yet. And there is an error in your second statement. In fact, If the customer pays with a \$500 bill, you need to give a change of 450 in total. However, you only give 150 in your statement. For example, this is a right solution. If `change\_100` is greater than 4 and `change\_50` is greater than 0, decrement `change\_100` by 4, decrement `change\_50` by 1, and increment `change\_500` by 1.



Apologies for the error in my previous statement. Thank you for pointing it out. I will not generate any code until instructed, and I appreciate the correction.

To provide an accurate solution, let's modify step 2 as follows:

2. Iterate through the `bills` array, representing each customer's payment:
  - If the customer pays with a \$50 bill, increment `change\_50` by 1.
  - If the customer pays with a \$100 bill, do the following:
    - Check if `change\_50` is greater than or equal to 1.
    - If so, decrement `change\_50` by 1 and increment `change\_100` by 1.
    - If not, return False, as you cannot provide the appropriate change.
  - If the customer pays with a \$500 bill, do the following:
    - Check if `change\_100` is greater than or equal to 4 and `change\_50` is greater than or equal to 1.
    - If so, decrement `change\_100` by 4, decrement `change\_50` by 1, and increment `change\_500` by 1.
    - If not, check if `change\_50` is greater than or equal to 3.
      - If so, decrement `change\_50` by 3 and increment `change\_500` by 1.
      - If neither condition is met, return False, as you cannot provide the appropriate change.



Please let me know if you have any further instructions or if there's anything else you'd like me to clarify.

# Coding with ChatGPT

- Step 3: Specify the errors in the statements and then give examples and guidance for the model to fix the errors.  
(Round 2)

There are conditions you are missing. Let me ask you how many conditions there are when you need to pay back a change of 450 with only \$50 bills and \$100 bills.



Apologies for the oversight. You are correct, there are additional conditions to consider when providing change of \$450 using \$50 and \$100 bills. Let's consider the different scenarios:

To give a change of \$450 using \$50 and \$100 bills:

- Check if `change\_100` is greater than or equal to 4 and `change\_50` is greater than or equal to 1:
  - If true, decrement `change\_100` by 4, decrement `change\_50` by 1, and increment `change\_500` by 1.
  - If false, continue to the next condition.
- Check if `change\_100` is greater than or equal to 3 and `change\_50` is greater than or equal to 3:
  - If true, decrement `change\_100` by 3, decrement `change\_50` by 3, and increment `change\_500` by 1.
  - If false, continue to the next condition.
- Check if `change\_100` is greater than or equal to 2 and `change\_50` is greater than or equal to 5:
  - If true, decrement `change\_100` by 2, decrement `change\_50` by 5, and increment `change\_500` by 1.
  - If false, continue to the next condition.
- Check if `change\_100` is greater than or equal to 1 and `change\_50` is greater than or equal to 7:
  - If true, decrement `change\_100` by 1, decrement `change\_50` by 7, and increment `change\_500` by 1.
  - If false, return False, as you cannot provide the appropriate change.

By including these additional conditions, we ensure that we can provide the correct change of \$450 using \$50 and \$100 bills.



Please let me know if you have further questions or if there's anything else I can assist you with.

# Coding with ChatGPT

- Step 4: Generate the code.

Good. Now update the Pseudo code of this problem.

Certainly! Here's an updated pseudo code for the problem, considering the additional conditions:

```
```
# Pseudo code for providing correct change using $50, $100, and $500 bills

# Initialize variables to keep track of available bills for each denomination
change_50 = 0
change_100 = 0
change_500 = 0

# Iterate through the bills array representing each customer's payment
for bill in bills:
    if bill == 50:
        # Increment change_50 by 1
        change_50 += 1
    elif bill == 100:
        if change_50 >= 1:
            # Decrement change_50 by 1 and increment change_100 by 1
            change_50 -= 1
            change_100 += 1
        else:
            # Unable to provide change, return False
            return False
    elif bill == 500:
        if change_100 >= 4 and change_50 >= 1:
            # Decrement change_100 by 4, decrement change_50 by 1, and increment change_500 by 1
            change_100 -= 4
            change_50 -= 1
            change_500 += 1
        elif change_100 >= 3 and change_50 >= 3:
            # Decrement change_100 by 3, decrement change_50 by 3, and increment change_500 by 1
            change_100 -= 3
            change_50 -= 3
            change_500 += 1
```

```

Good, now give me the python code and a few test examples.

Certainly! Here's the Python code implementation based on the updated pseudo code:

```
```
python
def provide_change(bills):
    # Initialize variables to keep track of available bills for each denomination
    change_50 = 0
    change_100 = 0
    change_500 = 0

    # Iterate through the bills array representing each customer's payment
    for bill in bills:
        if bill == 50:
            # Increment change_50 by 1
            change_50 += 1
        elif bill == 100:
            if change_50 >= 1:
                # Decrement change_50 by 1 and increment change_100 by 1
                change_50 -= 1
                change_100 += 1
            else:
                # Unable to provide change, return False
                return False
        elif bill == 500:
            if change_100 >= 4 and change_50 >= 1:
                # Decrement change_100 by 4, decrement change_50 by 1, and increment change_500 by 1
                change_100 -= 4
                change_50 -= 1
                change_500 += 1
            elif change_100 >= 3 and change_50 >= 3:
                # Decrement change_100 by 3, decrement change_50 by 3, and increment change_500 by 1
                change_100 -= 3
                change_50 -= 3
                change_500 += 1
```

```

# Coding with ChatGPT

- Code and result

```
def provide_change(bills):
    # Initialize variables to keep track of available bills for each denomination
    change_50 = 0
    change_100 = 0
    change_500 = 0

    # Iterate through the bills array representing each customer's payment
    for bill in bills:
        if bill == 50:
            # Increment change_50 by 1
            change_50 += 1
        elif bill == 100:
            if change_50 >= 1:
                # Decrement change_50 by 1 and increment change_100 by 1
                change_50 -= 1
                change_100 += 1
            else:
                # Unable to provide change, return False
                return False
        elif bill == 500:
            if change_100 >= 4 and change_50 >= 1:
                # Decrement change_100 by 4, decrement change_50 by 1, and increment change_500 by 1
                change_100 -= 4
                change_50 -= 1
                change_500 += 1
            elif change_100 >= 3 and change_50 >= 3:
                # Decrement change_100 by 3, decrement change_50 by 3, and increment change_500 by 1
                change_100 -= 3
                change_50 -= 3
                change_500 += 1
            elif change_100 >= 2 and change_50 >= 5:
                # Decrement change_100 by 2, decrement change_50 by 5, and increment change_500 by 1
                change_100 -= 2
                change_50 -= 5
                change_500 += 1
            elif change_100 >= 1 and change_50 >= 7:
                # Decrement change_100 by 1, decrement change_50 by 7, and increment change_500 by 1
                change_100 -= 1
                change_50 -= 7
                change_500 += 1
            else:
                # Unable to provide change, return False
                return False
    # Able to provide change to all customers, return True
    return True
```

```
bills = [50, 50, 50, 50, 100, 100, 50, 50, 100, 500]
print(provide_change(bills))
bills = [50, 50, 50, 100, 100, 50, 50, 500, 50]
print(provide_change(bills))
```

```
True
```

```
False
```

# Coding with ChatGPT

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- Requirements about coding with ChatGPT:
  - You are allowed and encouraged to code with ChatGPT in all the following lab sessions.
  - You should always check and understand the code and be responsible for your own work.
  - You should learn how to give good prompt inputs that leads to good output.
  - Use ChatGPT properly to improve the efficiency of coding and learning. Also have fun playing with ChatGPT.