

Final, 1010

Due by Midnight on May 13. Upload answers.

Turn in by uploading your answer.

Question 1. 200pts. Hand trace the following code showing the line number being executed and the values that the variable has. Show the output. You can create the answer with an Excel spreadsheet or on a mac with Numbers. Also a scanned image of a by-hand trace will work. An "empty" cell is an un-assigned value.

```
1:
2: print("At Top Of Question 1")
3:
4: # Create a Dicctionay to Store the Results from previous
5: # recursive calls.
6: fib_prev = {}
7:
8: def fib ( n ):
9:     global fib_prev      # Use global
10:    print ( "At top of Fib, n = {}".format( n ) )
11:    # if we have previously calcualted a value for
12:    # 'n' then return that value.
13:    if n in fib_prev:
14:        return fib_prev[n]
15:
16:    # if n == 0, then return 0, save result in
17:    # fib_prev
18:    if n <= 0:
19:        fib_prev[0] = 0
20:        return 0
21:
22:    # if n == 1, then return 1, save result in
23:    # fib_prev
24:    if n == 1:
25:        fib_prev[1] = 1
26:        return 1
27:
28:    # if n > 1, then recursively calcualte value to
29:    # return.  Save result in `fib_prev`
30:    x = fib(n-1) + fib(n-2)
31:    fib_prev[n] = x
32:    return x
33:
34: print ( "Fib of {} = {}".format( 3, fib ( 3 ) ) )
35:
```

Question 2

200pts. A significant problem with Machine Learning (ML) is systemic bias. Amazon used a system for filtering job applicant resumes that was shown to have a gender bias. A crime prediction system was shown to be racist. A system for recommending if inmates receive parole has been shown to be racist.

Write a 2 to 3 page paper on why systemic bias occurs in ML and what you can do to prevent it.

Turn in a .pdf of your paper.

References

1. What is Bias in ML systems: <https://towardsdatascience.com/understanding-and-reducing-bias-in-machine-learning-6565e23900ac>
2. Biased Parole System: <https://www.propublica.org/article/machine-bias-risk-assessments-in-criminal-sentencing>
3. Biased again women: <https://www.reuters.com/article/us-amazon-com-jobs-automation-insight/amazon-scraps-secret-ai-recruiting-tool-that-showed-bias-against-women-idUSKCN1MK08G>
4. Predictive Police ML biased <https://www.mic.com/articles/156286/crime-prediction-tool-pred-pol-only-amplifies-racially-biased-policing-study-shows>
5. Longevity Biotech is promoting/using ML. <https://psblab.org/?p=697>

Question 3

200pts. Write a 2 to 3 paper page on how you would go about generating Deep Fake voice content and how it can be used as a successful business. Explain why this will be a legal business. Some sample references are below. Add your own.

Turn in a .pdf of your paper.

References

1. Voice Deep Fake: <https://www.reuters.com/technology/that-radio-dj-you-hear-might-already-be-robot-2021-12-02/>
2. Video Deep Fake: <https://www.theguardian.com/technology/2020/jan/13/what-are-deepfakes-and-how-can-you-spot-them>
3. 14 Deep Fakes: <https://www.creativebloq.com/features/deepfake-examples>
4. A threat to Business Security: <https://securityintelligence.com/articles/why-deepfake-audio-technology-is-a-real-threat-to-enterprise-security/>
5. Deep fake can be a boon too: <https://timreview.ca/article/1282>

Question Extra.

If you think that you need extra credit or you want to skip one of the questions above... An extra Problem (worth the same as a lab, or $\frac{1}{3}$ of final)

200pts. Implement [Ackermann Function](#) in Python with a test case. Test for $m = 1$, $n = 2$. This should have a return value of 4, based on the Wikipedia article. Include your test case in the code. Turn in the working code.

Ackermann function is defined as:

$$A(m,n) = \begin{cases} n + 1 & \text{if } m = 0 \text{ and } n > 0 \\ A(m-1, 1) & \text{if } m > 0 \text{ and } n = 0 \\ A(m-1, A(m, n-1)) & \text{if } m > 0 \text{ and } n > 0 \end{cases}$$