Week 12 Tutorial

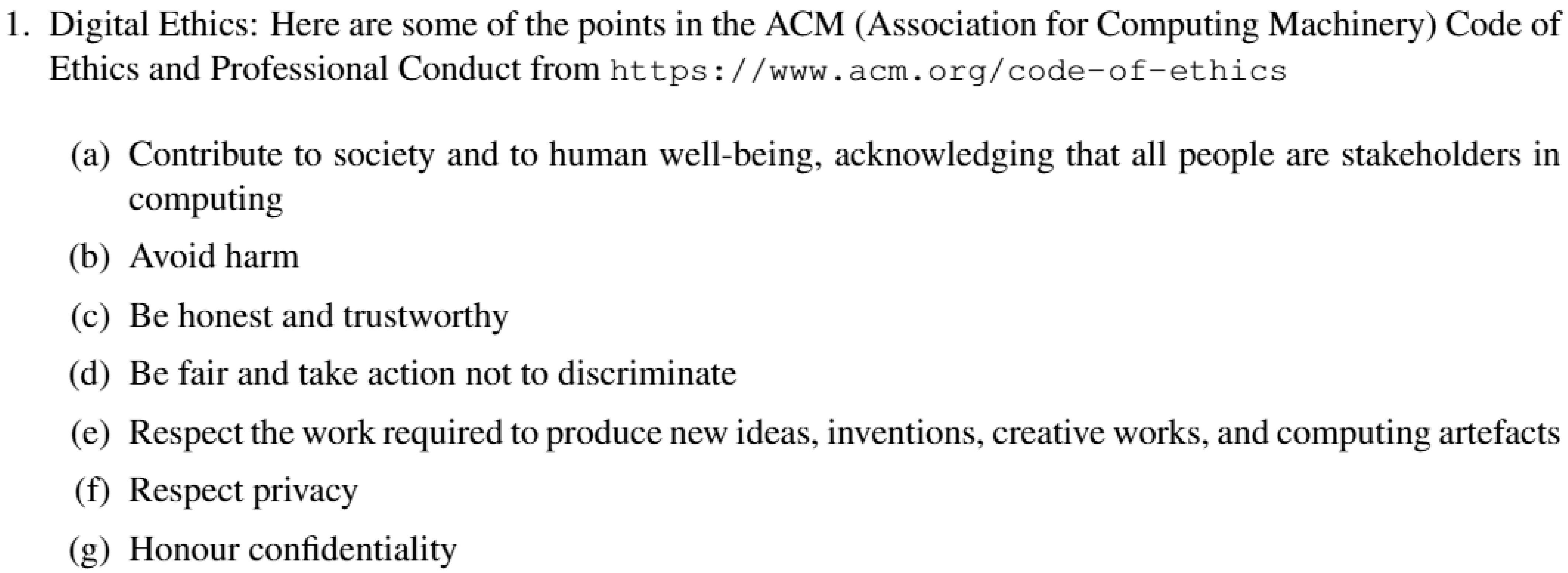
COMP10001 – Foundations of Computing

Semester 1, 2025

Clement Chau

- Digital Ethics
- Algorithms
- HTML

Revision: Digital Ethics



1. Digital Ethics: Here are some of the points in the ACM (Association for Computing Machinery) Code of Ethics and Professional Conduct from `https://www.acm.org/code-of-ethics`

   (a) Contribute to society and to human well-being, acknowledging that all people are stakeholders in computing

   (b) Avoid harm

   (c) Be honest and trustworthy

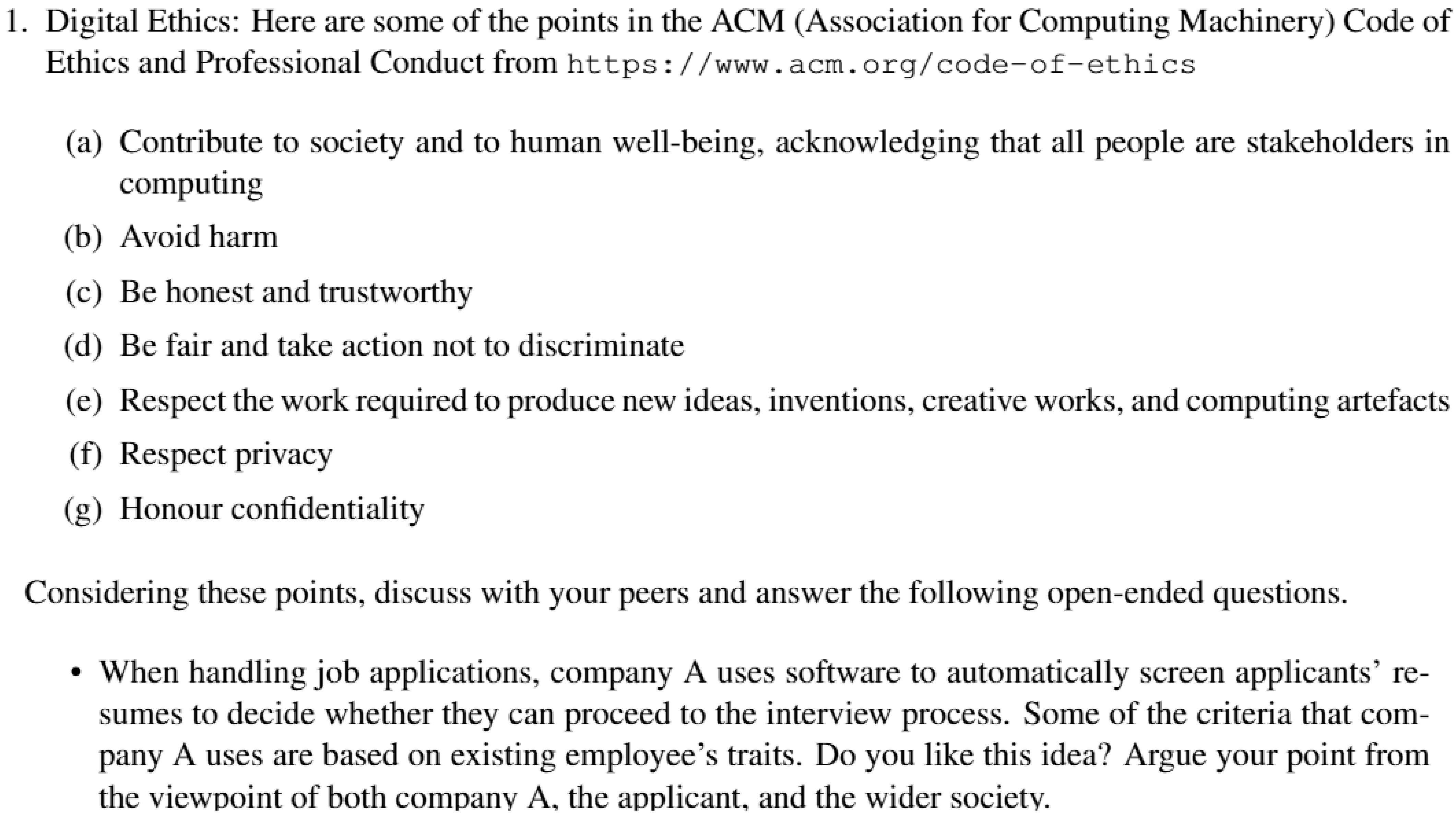
   (d) Be fair and take action not to discriminate

   (e) Respect the work required to produce new ideas, inventions, creative works, and computing artefacts

   (f) Respect privacy

   (g) Honour confidentiality

Exercise 1a, discuss!



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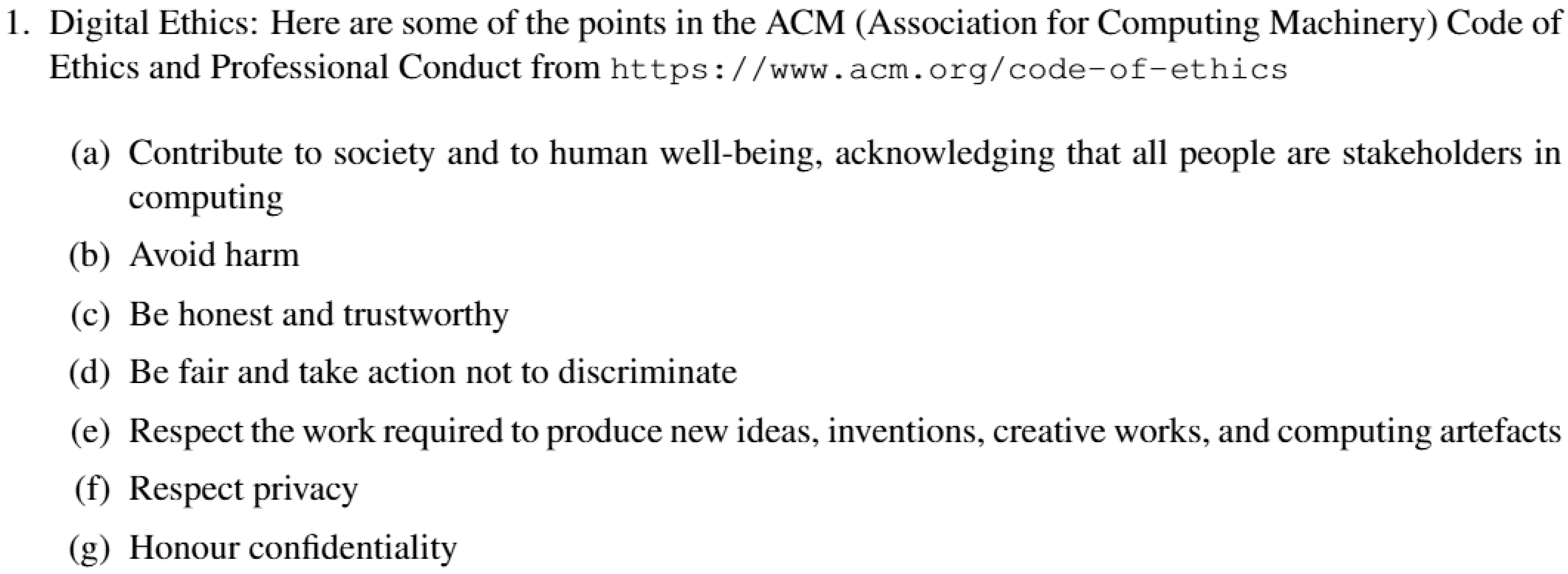
Considering these points, discuss with your peers and answer the following open-ended questions.

- When handling job applications, company A uses software to automatically screen applicants' resumes to decide whether they can proceed to the interview process. Some of the criteria that company A uses are based on existing employee's traits. Do you like this idea? Argue your point from the viewpoint of both company A, the applicant, and the wider society.

Exercise 1b, discuss!



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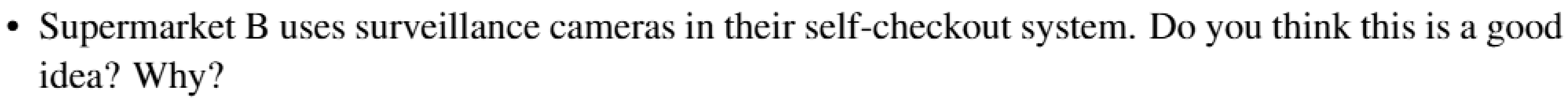
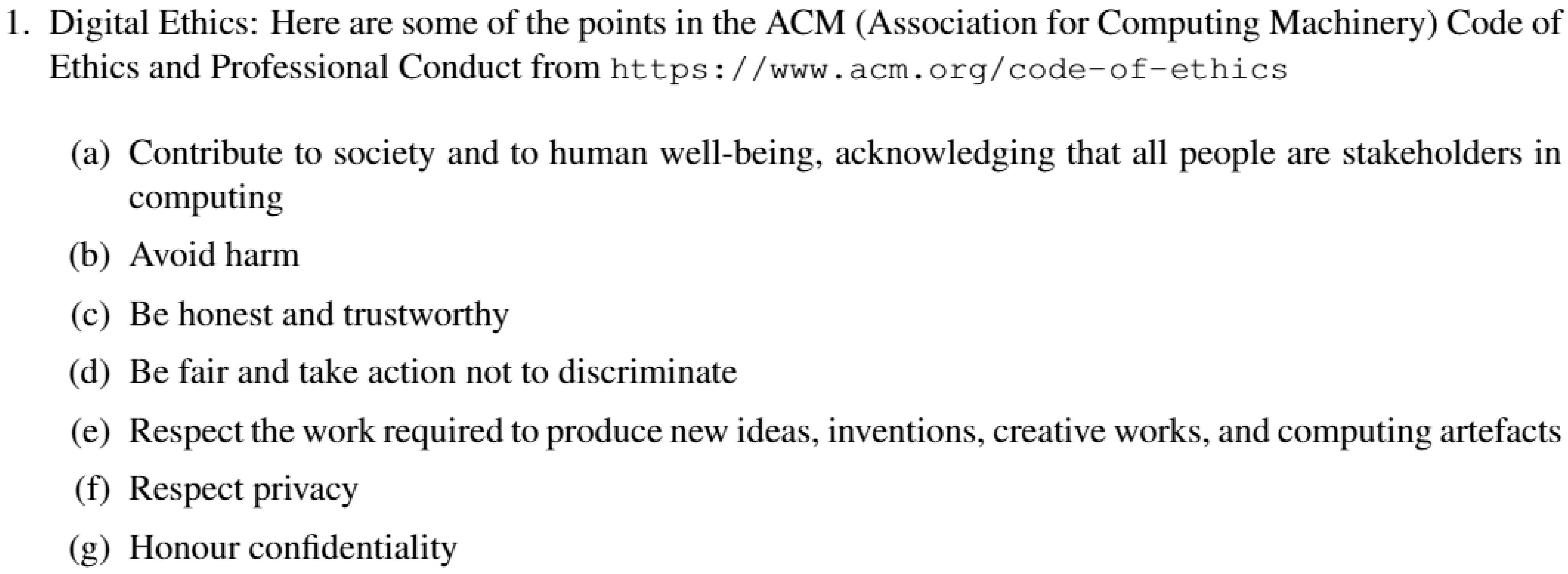


- Supermarket B uses surveillance cameras in their self-checkout system. Do you think this is a good idea? Why?

Exercise 1c, discuss!



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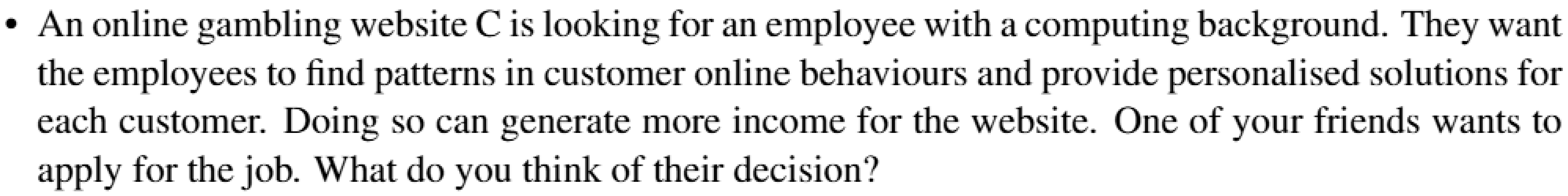
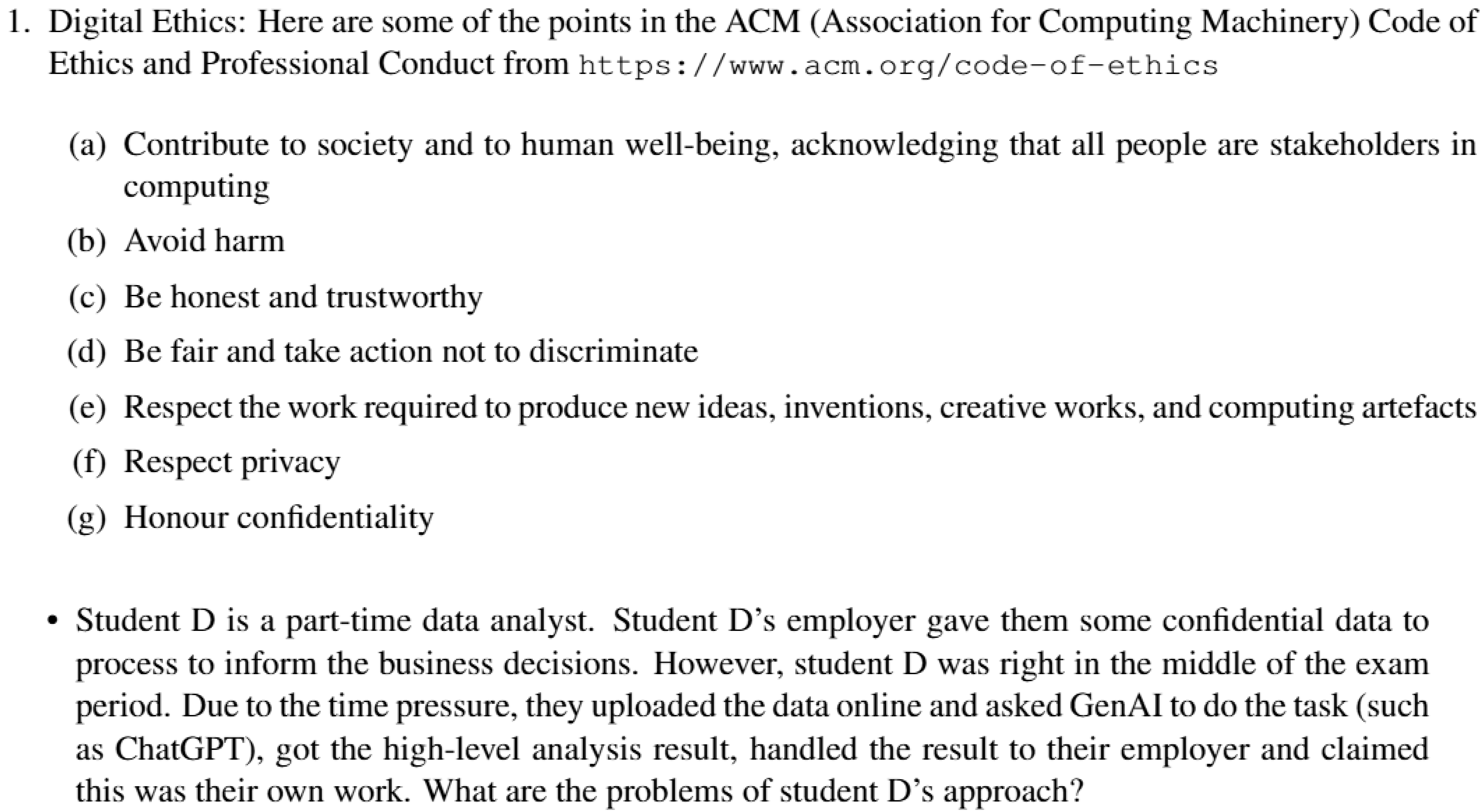


- An online gambling website C is looking for an employee with a computing background. They want the employees to find patterns in customer online behaviours and provide personalised solutions for each customer. Doing so can generate more income for the website. One of your friends wants to apply for the job. What do you think of their decision?

Exercise 1d, discuss!



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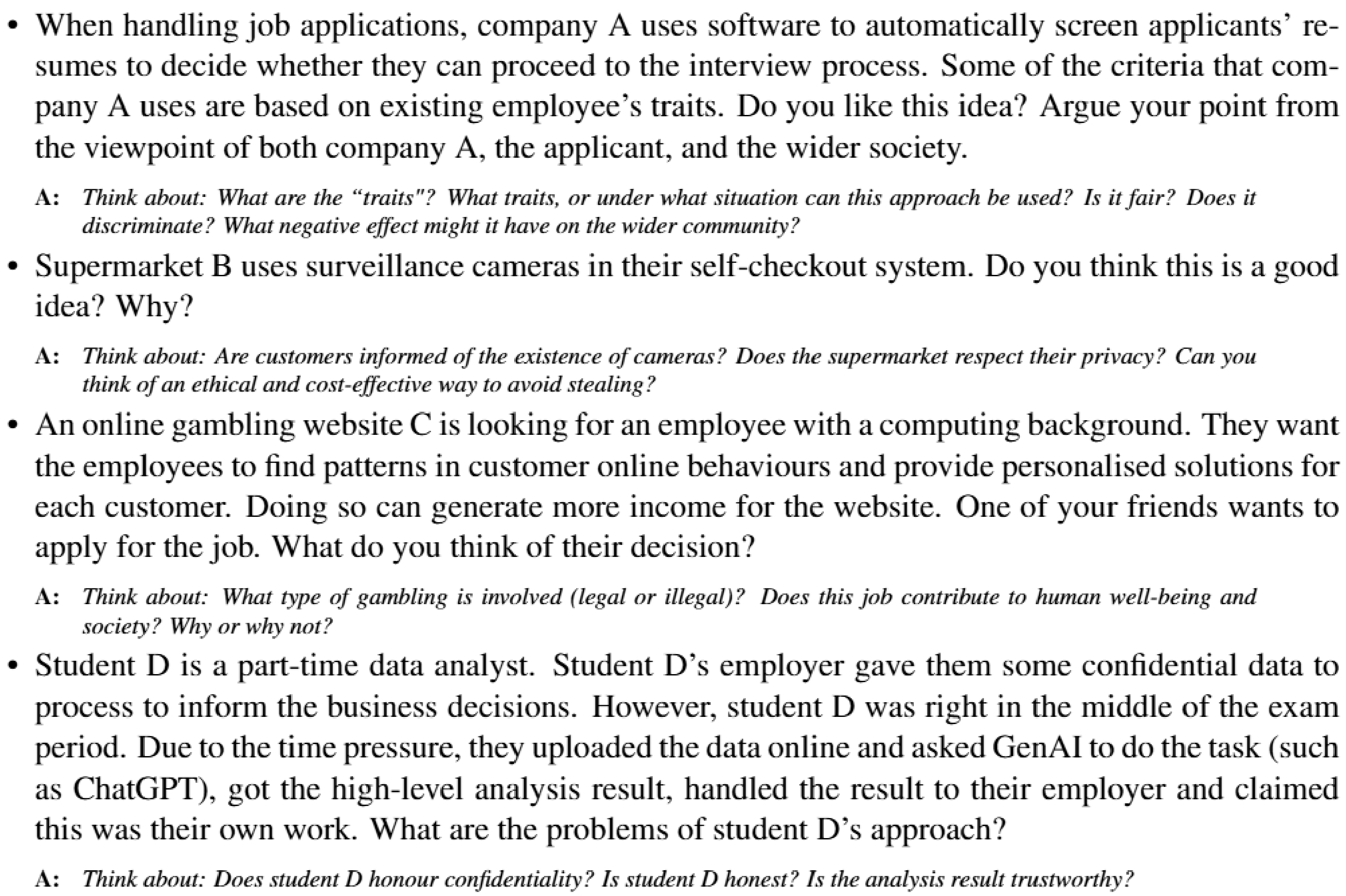
- Student D is a part-time data analyst. Student D's employer gave them some confidential data to process to inform the business decisions. However, student D was right in the middle of the exam period. Due to the time pressure, they uploaded the data online and asked GenAI to do the task (such as ChatGPT), got the high-level analysis result, handled the result to their employer and claimed this was their own work. What are the problems of student D's approach?

Answers to Exercise 1:



- When handling job applications, company A uses software to automatically screen applicants' resumes to decide whether they can proceed to the interview process. Some of the criteria that company A uses are based on existing employee's traits. Do you like this idea? Argue your point from the viewpoint of both company A, the applicant, and the wider society.

  A: *Think about: What are the “traits"? What traits, or under what situation can this approach be used? Is it fair? Does it discriminate? What negative effect might it have on the wider community?*

- Supermarket B uses surveillance cameras in their self-checkout system. Do you think this is a good idea? Why?

  A: *Think about: Are customers informed of the existence of cameras? Does the supermarket respect their privacy? Can you think of an ethical and cost-effective way to avoid stealing?*

- An online gambling website C is looking for an employee with a computing background. They want the employees to find patterns in customer online behaviours and provide personalised solutions for each customer. Doing so can generate more income for the website. One of your friends wants to apply for the job. What do you think of their decision?

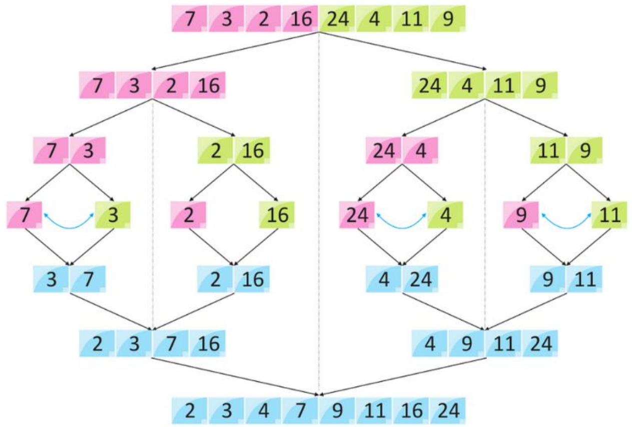
  A: *Think about: What type of gambling is involved (legal or illegal)? Does this job contribute to human well-being and society? Why or why not?*

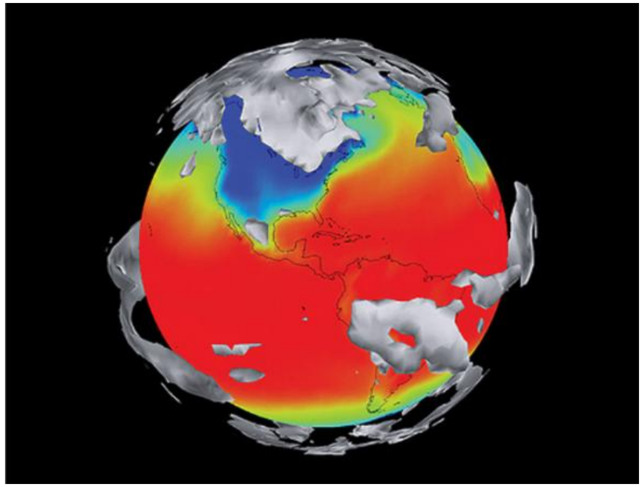
- Student D is a part-time data analyst. Student D's employer gave them some confidential data to process to inform the business decisions. However, student D was right in the middle of the exam period. Due to the time pressure, they uploaded the data online and asked GenAI to do the task (such as ChatGPT), got the high-level analysis result, handled the result to their employer and claimed this was their own work. What are the problems of student D's approach?

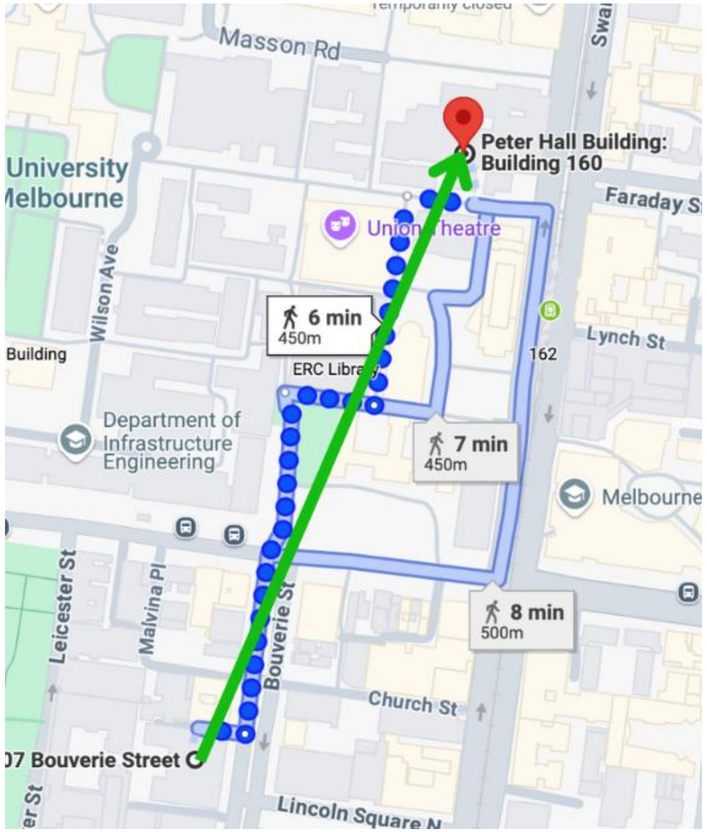
  A: *Think about: Does student D honour confidentiality? Is student D honest? Is the analysis result trustworthy?*

Revision: Algorithms

- Criteria to judge algorithms?
  - Correctness
  - Efficiency
    - Time Complexity
    - Space Complexity
- Two types of algorithms?
  - Exact
    - Brute Force
    - Divide and Conquer
  - Approximate
    - Simulation
    - Heuristic Search



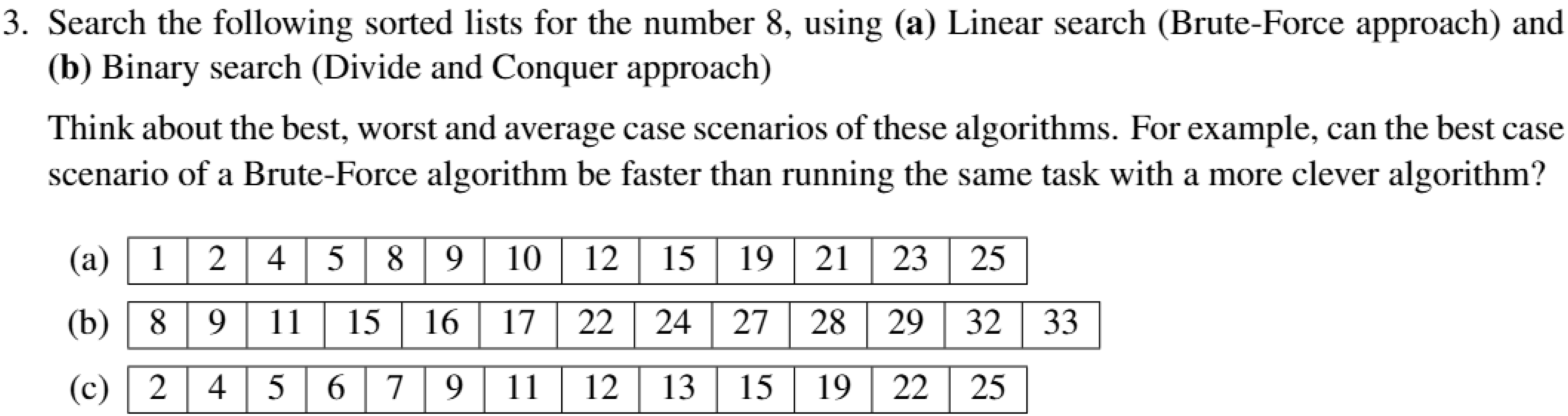




Revision: Linear Search and Binary Search

- Linear Search
  - Does **not** require the elements to be sorted first.
  - Goes through all elements in the list, **iteratively**.
  - **Brute-Force Approach.**
  - Worst case scenario (Time Complexity): **O(n)**
- Binary Search
  - Requires the elements to be **sorted** first.
  - For every iteration,
    - Divides the list into 2 equal length.
    - Continues **searching on only one-half** of the list and **discards the other**.
    - Repeats until an element is found, or it's exhausted of elements to search on (Element is not found in the list).
  - **Divide and Conquer Approach.**
  - Worst case scenario (Time Complexity): **O(log n)**

Exercise 3, linear search and binary search

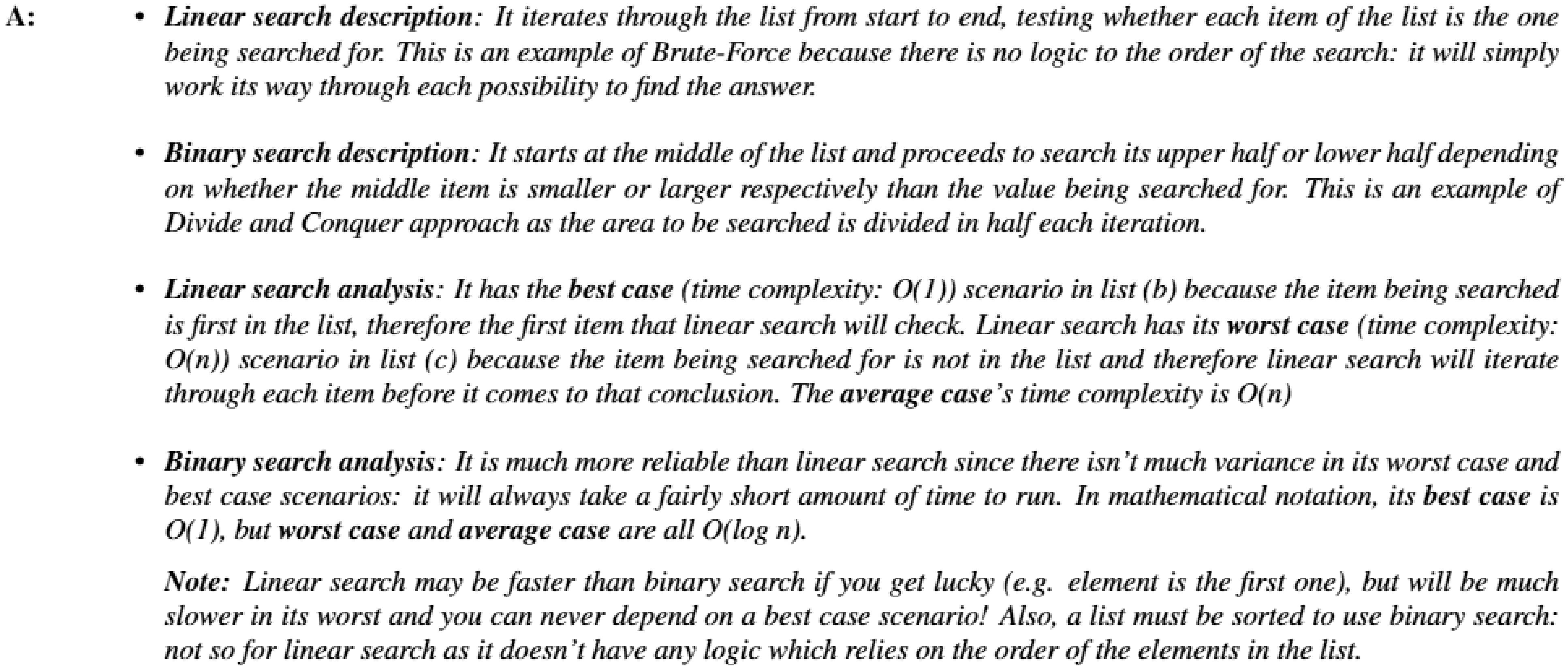


3. Search the following sorted lists for the number 8, using **(a)** Linear search (Brute-Force approach) and **(b)** Binary search (Divide and Conquer approach)

   Think about the best, worst and average case scenarios of these algorithms. For example, can the best case scenario of a Brute-Force algorithm be faster than running the same task with a more clever algorithm?

(a)	1	2	4	5	8	9	10	12	15	19	21	23	25
(b)	8	9	11	15	16	17	22	24	27	28	29	32	33
(c)	2	4	5	6	7	9	11	12	13	15	19	22	25

Answer to Exercise 3:



A:

- ***Linear search description****: It iterates through the list from start to end, testing whether each item of the list is the one being searched for. This is an example of Brute-Force because there is no logic to the order of the search: it will simply work its way through each possibility to find the answer.*

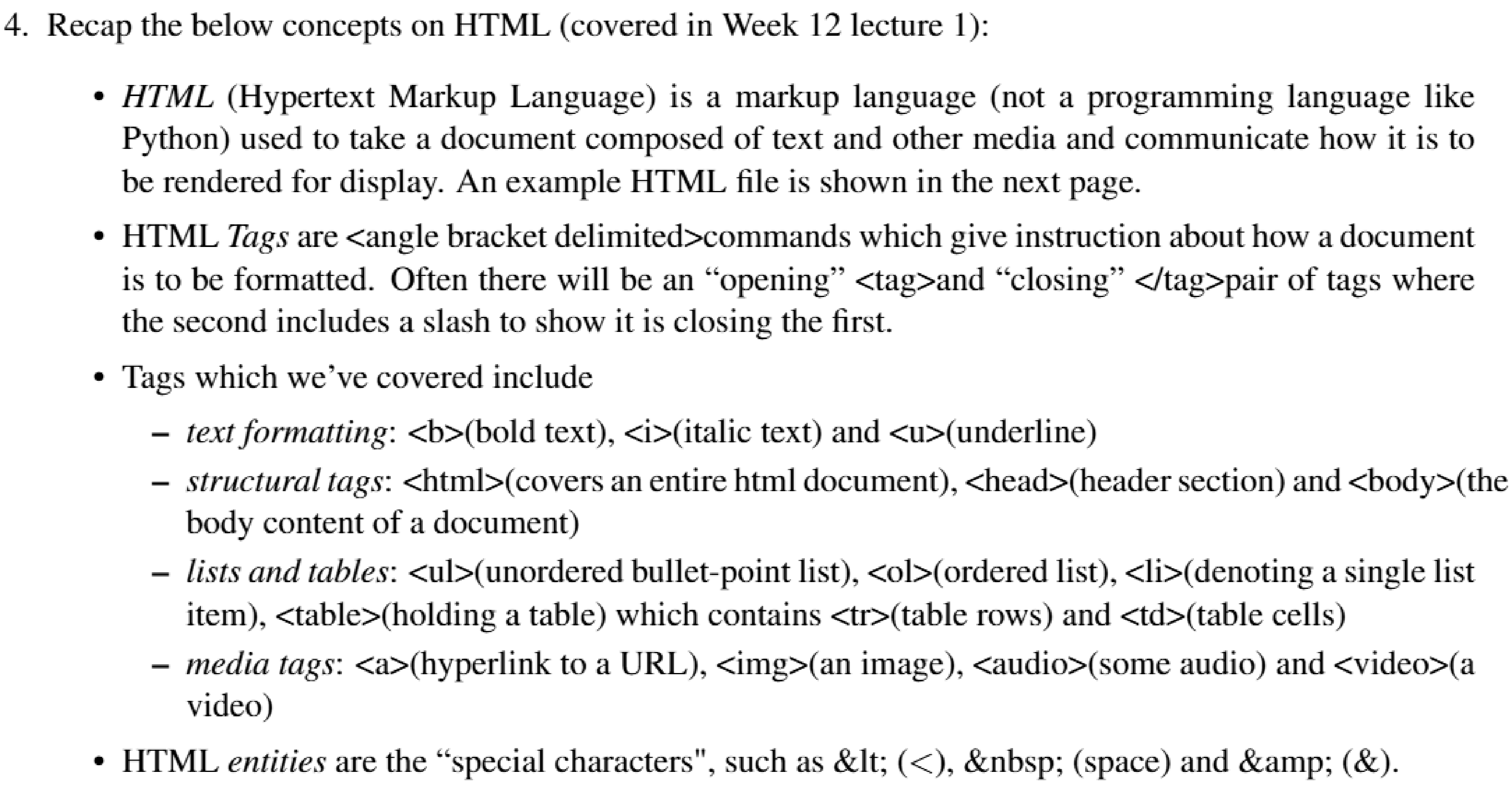
- ***Binary search description****: It starts at the middle of the list and proceeds to search its upper half or lower half depending on whether the middle item is smaller or larger respectively than the value being searched for. This is an example of Divide and Conquer approach as the area to be searched is divided in half each iteration.*

- ***Linear search analysis****: It has the* ***best case*** *(time complexity: O(1)) scenario in list (b) because the item being searched is first in the list, therefore the first item that linear search will check. Linear search has its* ***worst case*** *(time complexity: O(n)) scenario in list (c) because the item being searched for is not in the list and therefore linear search will iterate through each item before it comes to that conclusion. The* ***average case****'s time complexity is O(n)*

- ***Binary search analysis****: It is much more reliable than linear search since there isn't much variance in its worst case and best case scenarios: it will always take a fairly short amount of time to run. In mathematical notation, its* ***best case*** *is O(1), but* ***worst case*** *and* ***average case*** *are all O(log n).*

  Note: *Linear search may be faster than binary search if you get lucky (e.g. element is the first one), but will be much slower in its worst and you can never depend on a best case scenario! Also, a list must be sorted to use binary search: not so for linear search as it doesn't have any logic which relies on the order of the elements in the list.*

Revision: HTML



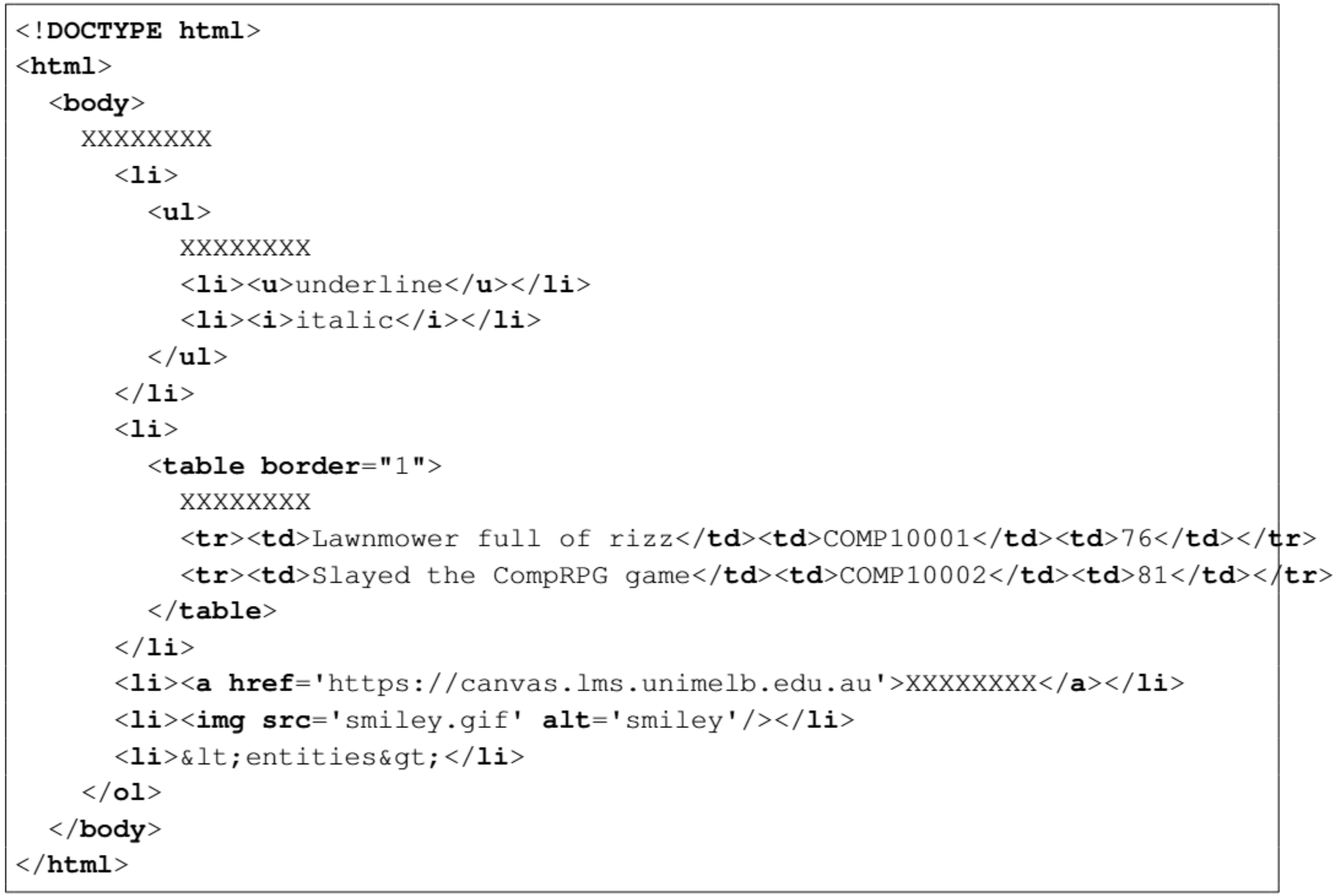
4. Recap the below concepts on HTML (covered in Week 12 lecture 1):

   - *HTML* (Hypertext Markup Language) is a markup language (not a programming language like Python) used to take a document composed of text and other media and communicate how it is to be rendered for display. An example HTML file is shown in the next page.
   - HTML *Tags* are <angle bracket delimited>commands which give instruction about how a document is to be formatted. Often there will be an "opening" <tag>and "closing" </tag>pair of tags where the second includes a slash to show it is closing the first.
   - Tags which we've covered include
     - *text formatting*: <b>(bold text), <i>(italic text) and <u>(underline)
     - *structural tags*: <html>(covers an entire html document), <head>(header section) and <body>(the body content of a document)
     - *lists and tables*: <ul>(unordered bullet-point list), <ol>(ordered list), <li>(denoting a single list item), <table>(holding a table) which contains <tr>(table rows) and <td>(table cells)
     - *media tags*: <a>(hyperlink to a URL), <img>(an image), <audio>(some audio) and <video>(a video)
   - HTML *entities* are the "special characters", such as &lt; (<), &nbsp; (space) and &amp; (&).

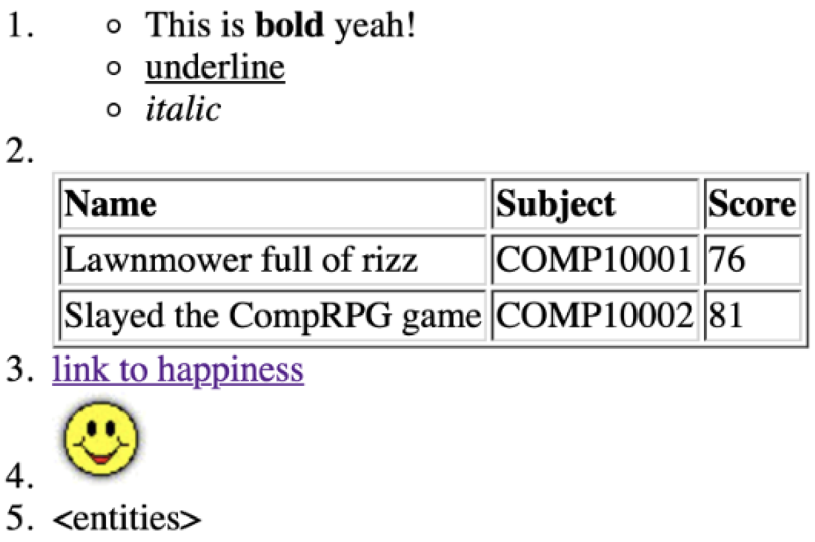
Exercise 5, HTML fill in the blanks

5. Below is an incomplete HTML script. After completion, the result will look like Fig 1. Answer the following questions:

- Complete the HTML by filling the "XXXXXXXX" part. You can run your HTML code and check the result here: `https://www.w3schools.com/html/tryit.asp?filename=tryhtml_default`
- What is the "link to happiness"? What if the image is not shown properly?



```
<!DOCTYPE html>
<html>
  <body>
    XXXXXXXX
      <li>
        <ul>
          XXXXXXXX
          <li><u>underline</u></li>
          <li><i>italic</i></li>
        </ul>
      </li>
      <li>
        <table border="1">
          XXXXXXXX
          <tr><td>Lawnmower full of rizz</td><td>COMP10001</td><td>76</td></tr>
          <tr><td>Slayed the CompRPG game</td><td>COMP10002</td><td>81</td></tr>
        </table>
      </li>
      <li><a href='https://canvas.lms.unimelb.edu.au'>XXXXXXXX</a></li>
      <li><img src='smiley.gif' alt='smiley'/></li>
      <li>&lt;entities&gt;</li>
    </ol>
  </body>
</html>
```



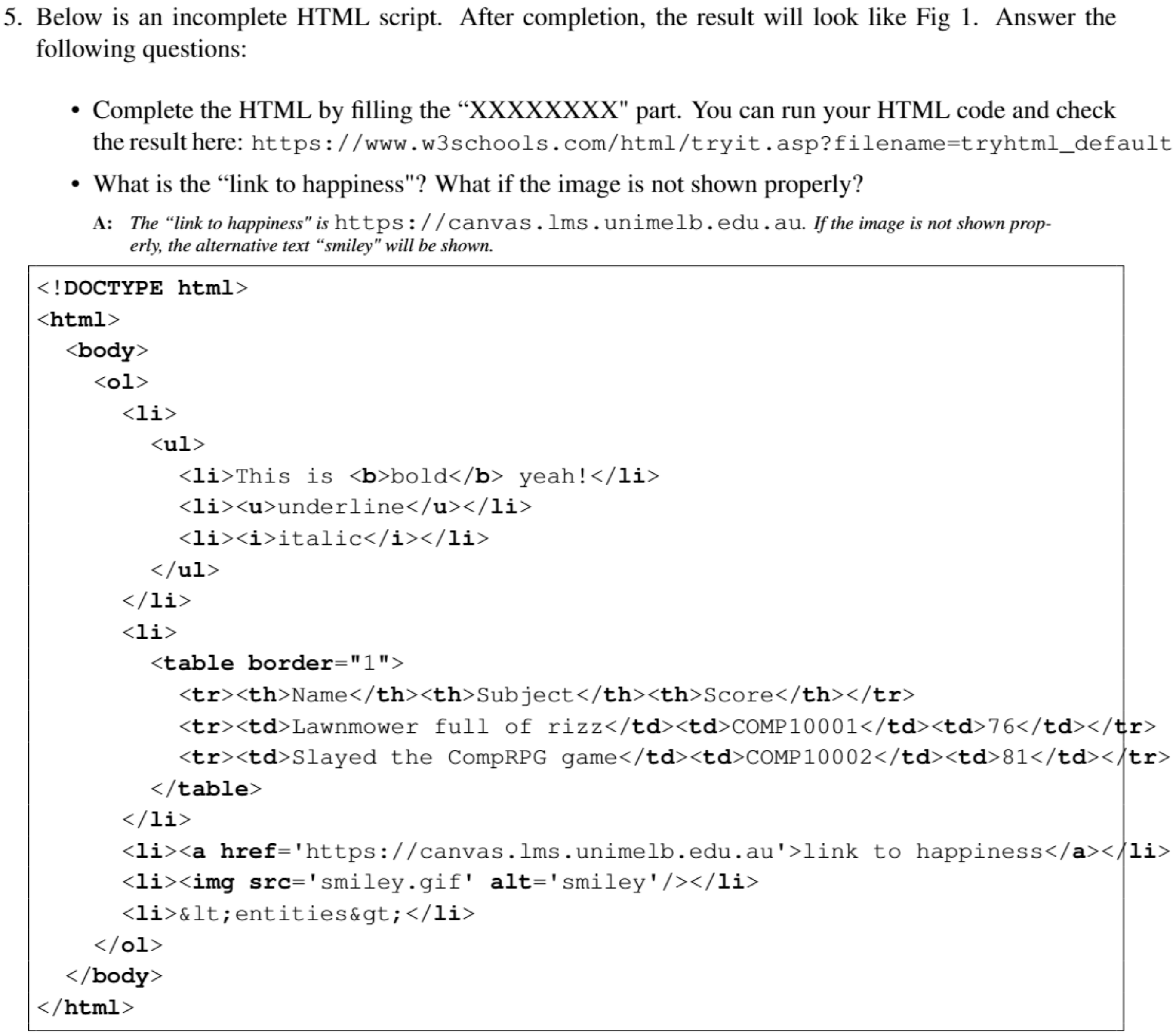
1.
    - This is **bold** yeah!
    - underline
    - *italic*
2.

Name	Subject	Score
Lawnmower full of rizz	COMP10001	76
Slayed the CompRPG game	COMP10002	81

3. link to happiness
4.
5. <entities>

Figure 1: The result of the above html.

Answers to Exercise 5:



5. Below is an incomplete HTML script. After completion, the result will look like Fig 1. Answer the following questions:

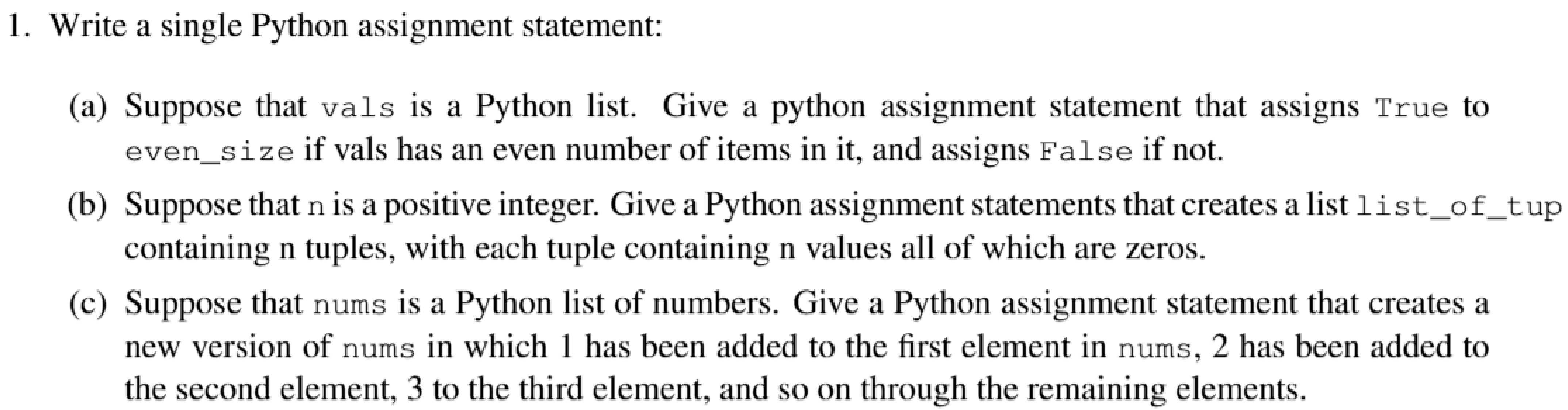
    - Complete the HTML by filling the “XXXXXXXX" part. You can run your HTML code and check the result here: `https://www.w3schools.com/html/tryit.asp?filename=tryhtml_default`
    - What is the “link to happiness"? What if the image is not shown properly?

    A: *The “link to happiness" is* `https://canvas.lms.unimelb.edu.au`. *If the image is not shown properly, the alternative text “smiley" will be shown.*

```
<!DOCTYPE html>
<html>
  <body>
    <ol>
      <li>
        <ul>
          <li>This is <b>bold</b> yeah!</li>
          <li><u>underline</u></li>
          <li><i>italic</i></li>
        </ul>
      </li>
      <li>
        <table border="1">
          <tr><th>Name</th><th>Subject</th><th>Score</th></tr>
          <tr><td>Lawnmower full of rizz</td><td>COMP10001</td><td>76</td></tr>
          <tr><td>Slayed the CompRPG game</td><td>COMP10002</td><td>81</td></tr>
        </table>
      </li>
      <li><a href='https://canvas.lms.unimelb.edu.au'>link to happiness</a></li>
      <li><img src='smiley.gif' alt='smiley'/></li>
      <li>&lt;entities&gt;</li>
    </ol>
  </body>
</html>
```

Programming Practice

Question 1, one-liners



1. Write a single Python assignment statement:

   (a) Suppose that `vals` is a Python list. Give a python assignment statement that assigns `True` to `even_size` if vals has an even number of items in it, and assigns `False` if not.

   (b) Suppose that `n` is a positive integer. Give a Python assignment statements that creates a list `list_of_tup` containing n tuples, with each tuple containing n values all of which are zeros.

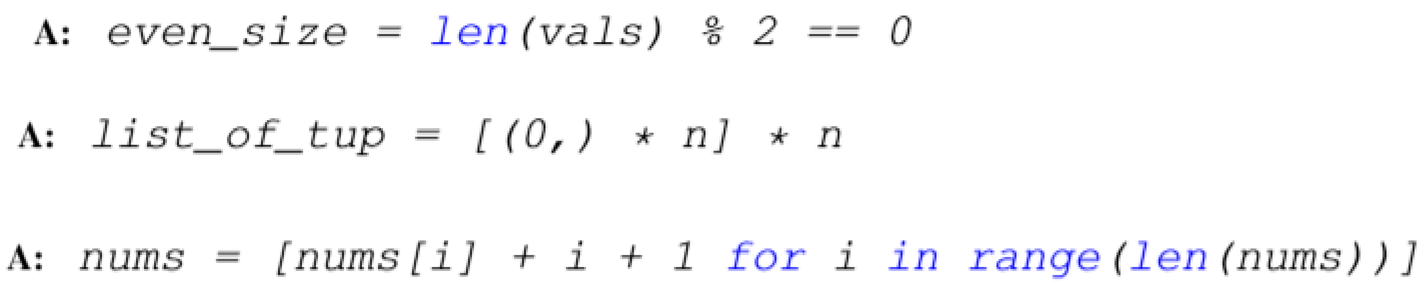
   (c) Suppose that `nums` is a Python list of numbers. Give a Python assignment statement that creates a new version of `nums` in which 1 has been added to the first element in `nums`, 2 has been added to the second element, 3 to the third element, and so on through the remaining elements.

Answers:

(a)

(b)

(c)

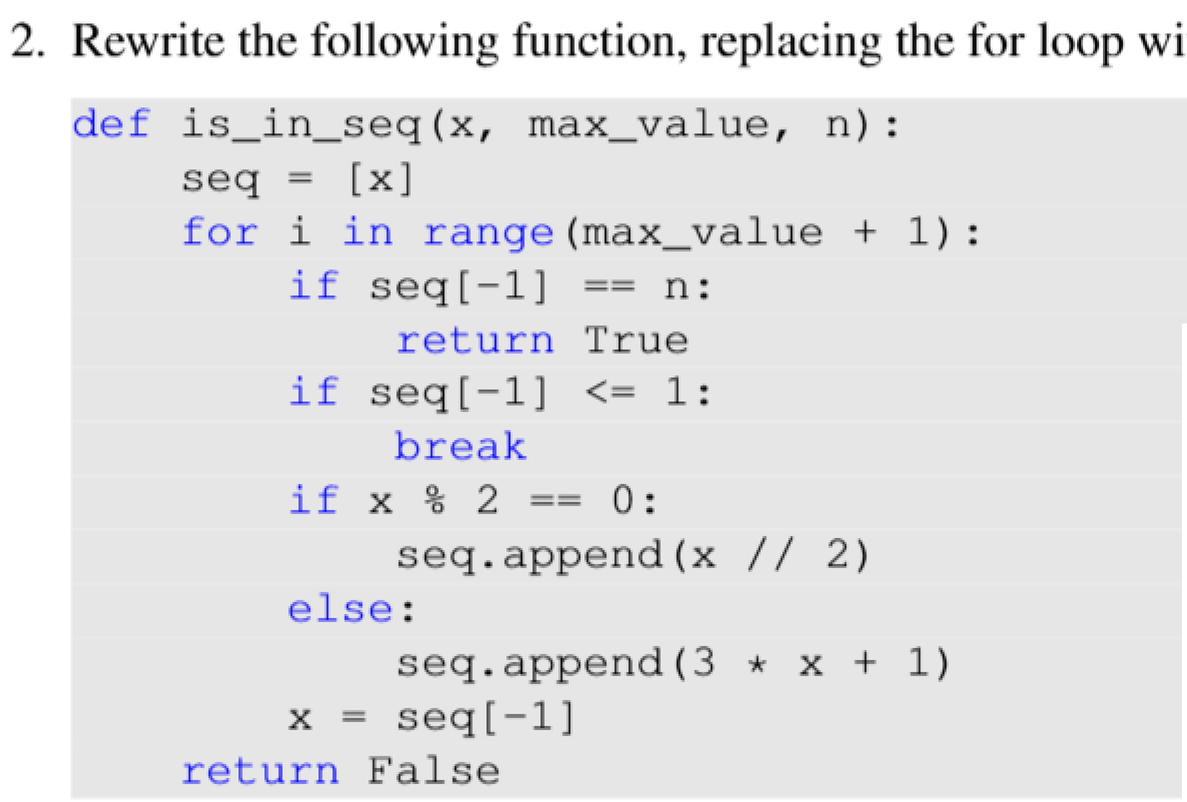


A: `even_size = len(vals) % 2 == 0`

A: `list_of_tup = [(0,) * n] * n`

A: `nums = [nums[i] + i + 1 for i in range(len(nums))]`

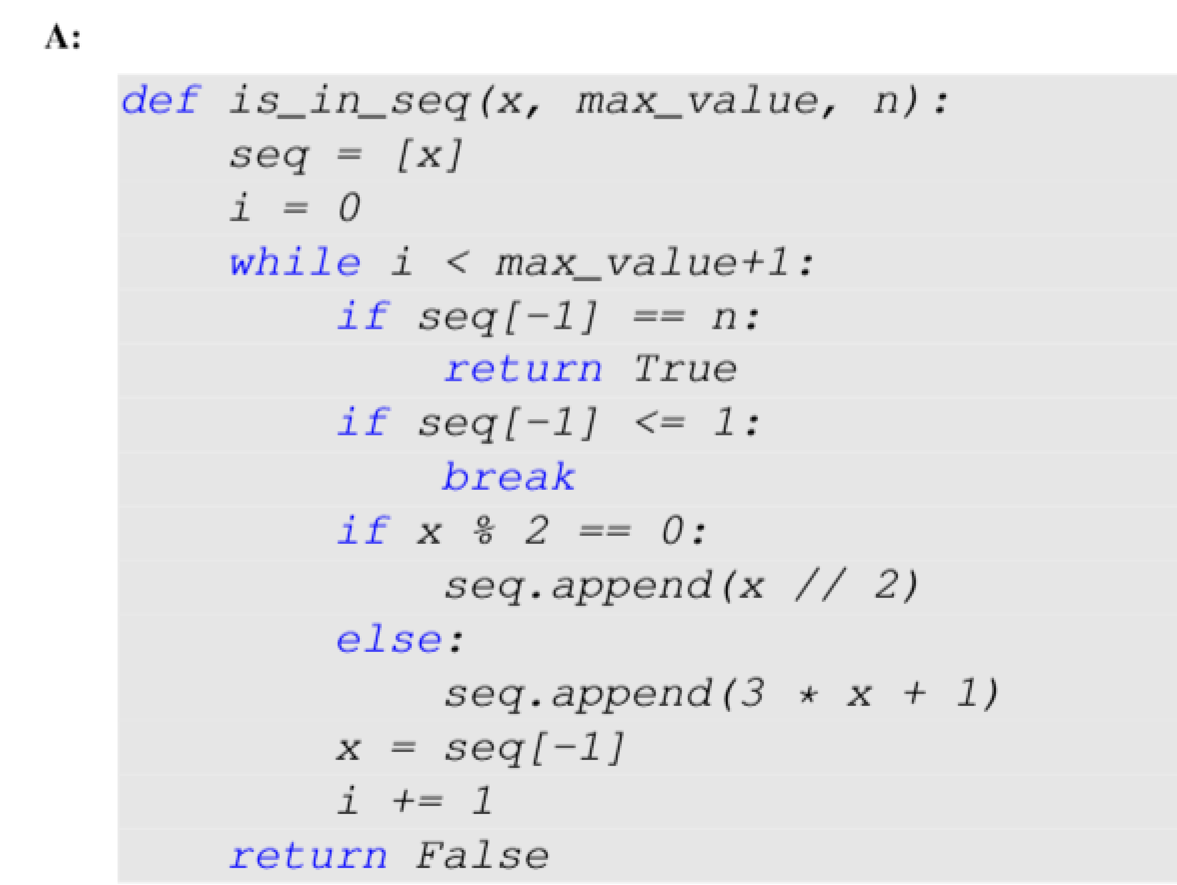
Question 2, for -> while



2. Rewrite the following function, replacing the for loop with a while loop without changing its structure:

```
def is_in_seq(x, max_value, n):
    seq = [x]
    for i in range(max_value + 1):
        if seq[-1] == n:
            return True
        if seq[-1] <= 1:
            break
        if x % 2 == 0:
            seq.append(x // 2)
        else:
            seq.append(3 * x + 1)
        x = seq[-1]
    return False
```

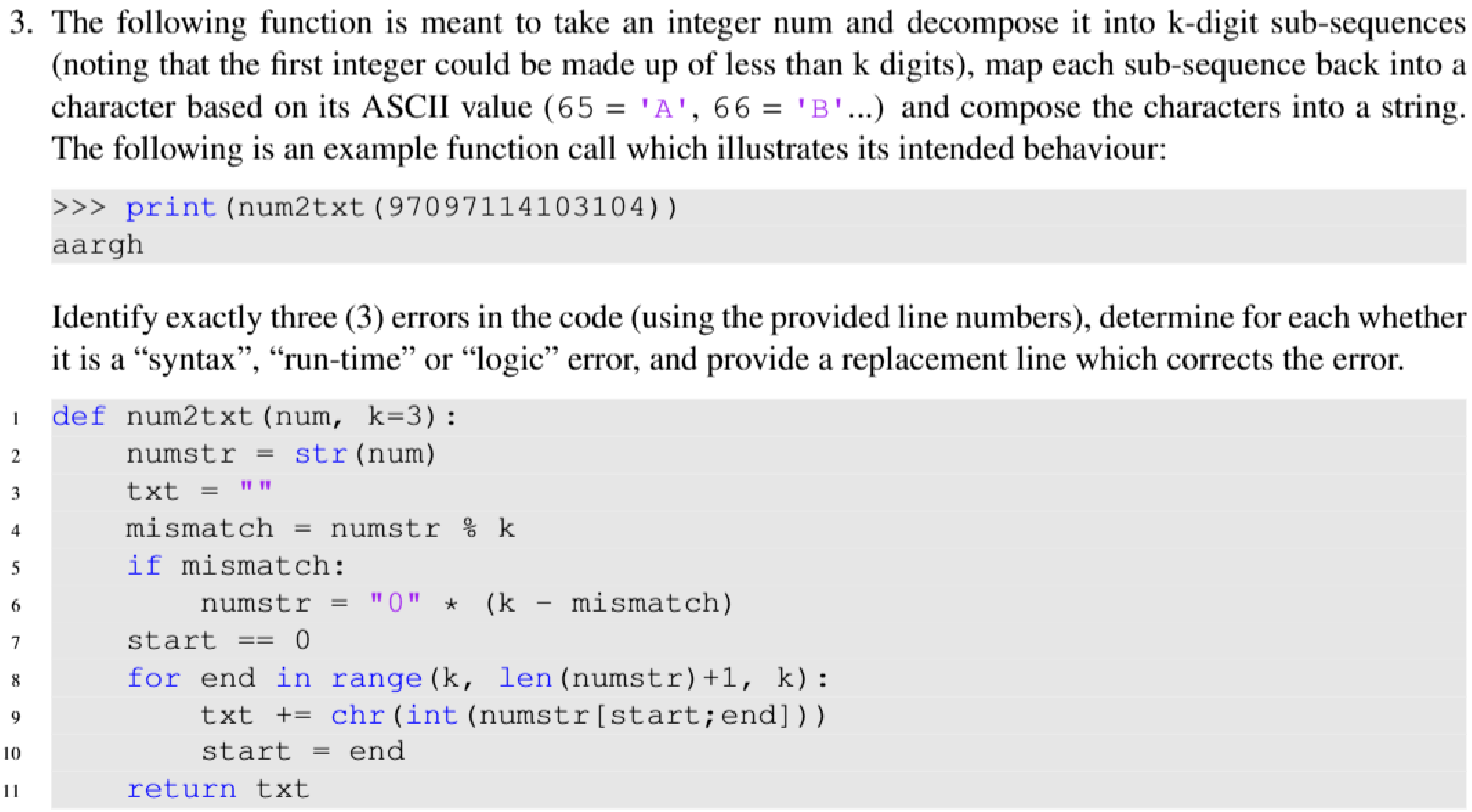
Answer:



A:

```
def is_in_seq(x, max_value, n):
    seq = [x]
    i = 0
    while i < max_value+1:
        if seq[-1] == n:
            return True
        if seq[-1] <= 1:
            break
        if x % 2 == 0:
            seq.append(x // 2)
        else:
            seq.append(3 * x + 1)
        x = seq[-1]
        i += 1
    return False
```

Question 3, identify the errors



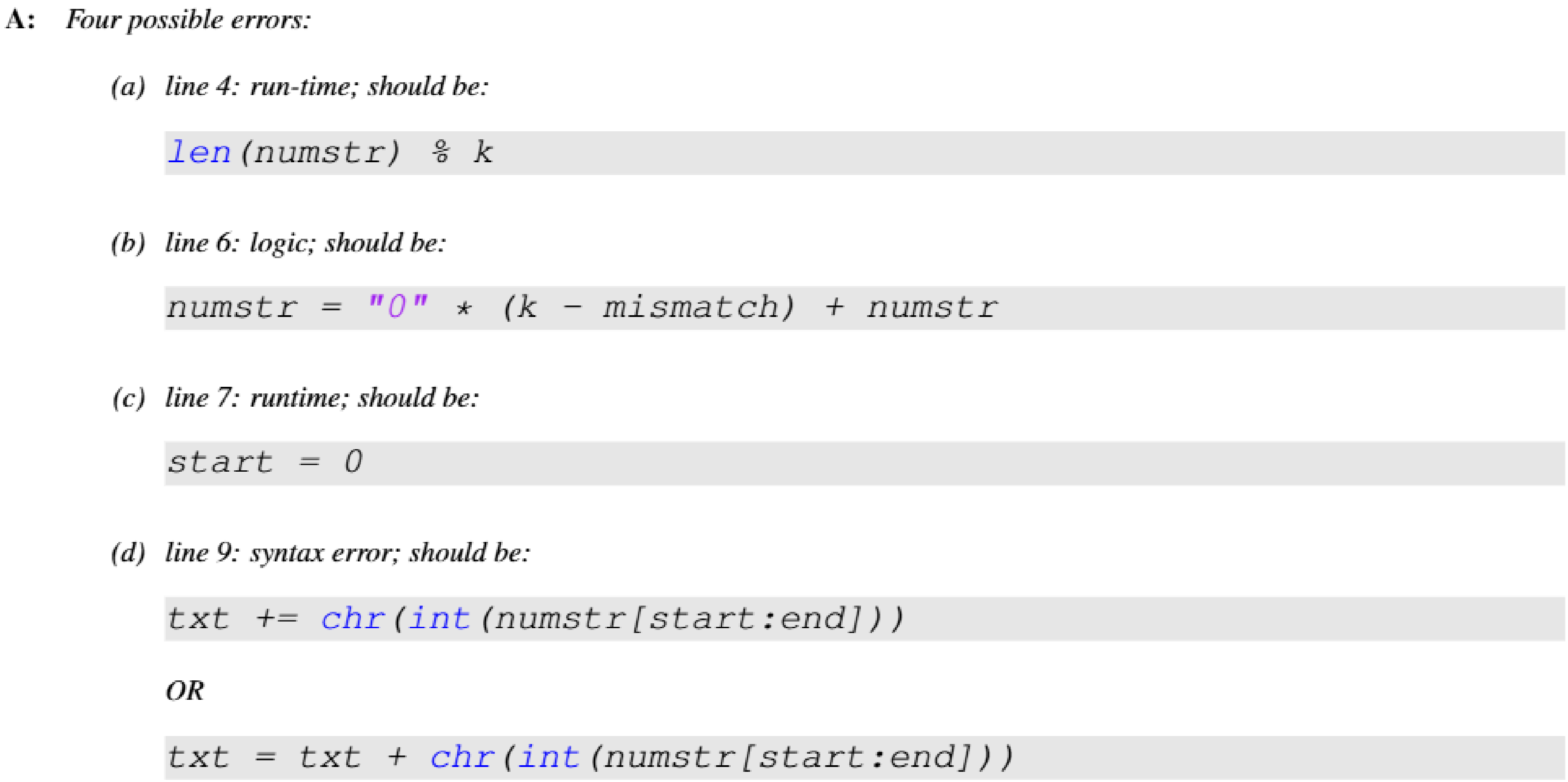
3. The following function is meant to take an integer num and decompose it into k-digit sub-sequences (noting that the first integer could be made up of less than k digits), map each sub-sequence back into a character based on its ASCII value (65 = 'A', 66 = 'B'...) and compose the characters into a string. The following is an example function call which illustrates its intended behaviour:

```
>>> print(num2txt(97097114103104))
aargh
```

Identify exactly three (3) errors in the code (using the provided line numbers), determine for each whether it is a “syntax”, “run-time” or “logic” error, and provide a replacement line which corrects the error.

```
1  def num2txt(num, k=3):
2      numstr = str(num)
3      txt = ""
4      mismatch = numstr % k
5      if mismatch:
6          numstr = "0" * (k - mismatch)
7      start == 0
8      for end in range(k, len(numstr)+1, k):
9          txt += chr(int(numstr[start;end]))
10         start = end
11     return txt
```

Answer to Question 3:



A: *Four possible errors:*

(a) *line 4: run-time; should be:*

```
len(numstr) % k
```

(b) *line 6: logic; should be:*

```
numstr = "0" * (k - mismatch) + numstr
```

(c) *line 7: runtime; should be:*

```
start = 0
```

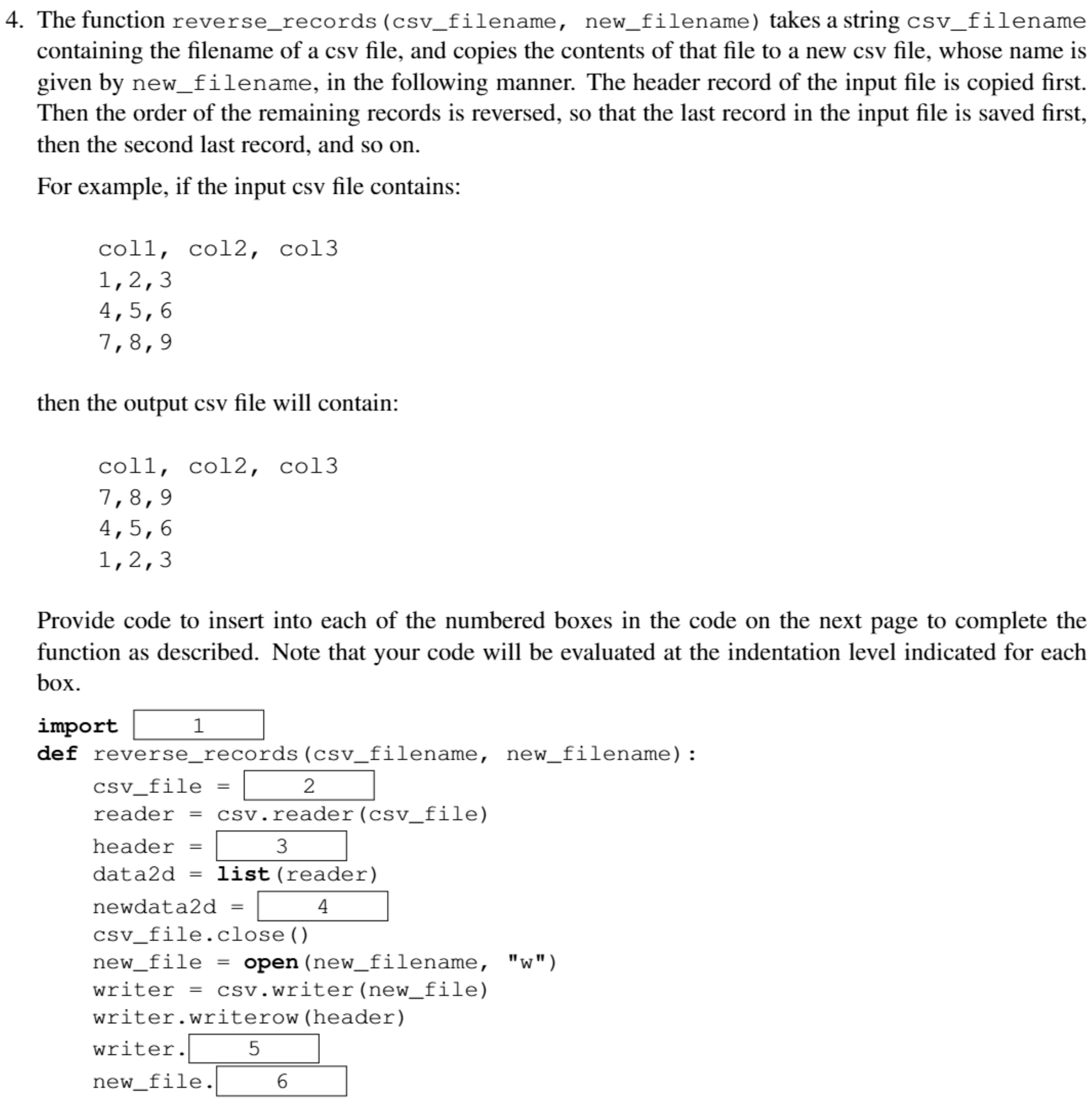
(d) *line 9: syntax error; should be:*

```
txt += chr(int(numstr[start:end]))
```

OR

```
txt = txt + chr(int(numstr[start:end]))
```

Question 4, fill in the blanks (CSV)



4. The function `reverse_records(csv_filename, new_filename)` takes a string `csv_filename` containing the filename of a csv file, and copies the contents of that file to a new csv file, whose name is given by `new_filename`, in the following manner. The header record of the input file is copied first. Then the order of the remaining records is reversed, so that the last record in the input file is saved first, then the second last record, and so on.

For example, if the input csv file contains:

```
col1, col2, col3
1,2,3
4,5,6
7,8,9
```

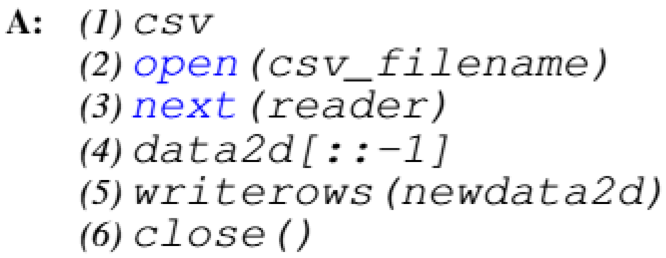
then the output csv file will contain:

```
col1, col2, col3
7,8,9
4,5,6
1,2,3
```

Provide code to insert into each of the numbered boxes in the code on the next page to complete the function as described. Note that your code will be evaluated at the indentation level indicated for each box.

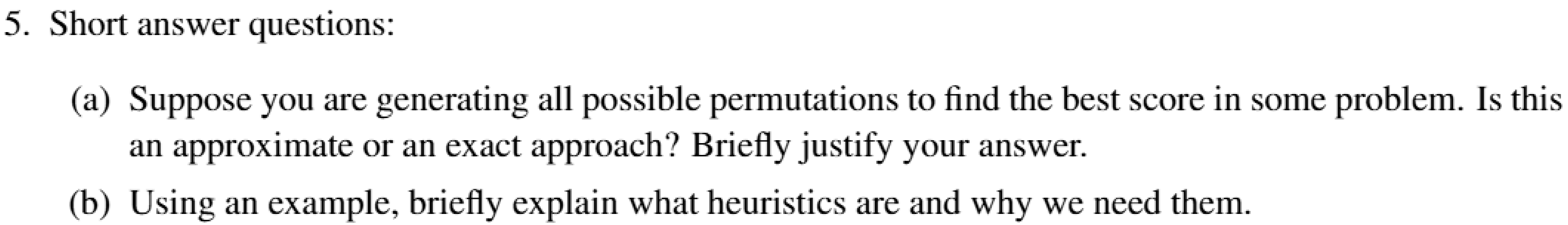
```
import [  1  ]
def reverse_records(csv_filename, new_filename):
    csv_file = [  2  ]
    reader = csv.reader(csv_file)
    header = [  3  ]
    data2d = list(reader)
    newdata2d = [  4  ]
    csv_file.close()
    new_file = open(new_filename, "w")
    writer = csv.writer(new_file)
    writer.writerow(header)
    writer.[  5  ]
    new_file.[  6  ]
```

Answer:



A: *(1)* `csv`
(2) `open(csv_filename)`
(3) `next(reader)`
(4) `data2d[::-1]`
(5) `writerows(newdata2d)`
(6) `close()`

Question 5, short answer questions



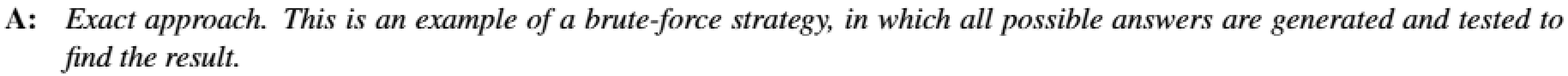
5. Short answer questions:

   (a) Suppose you are generating all possible permutations to find the best score in some problem. Is this an approximate or an exact approach? Briefly justify your answer.

   (b) Using an example, briefly explain what heuristics are and why we need them.

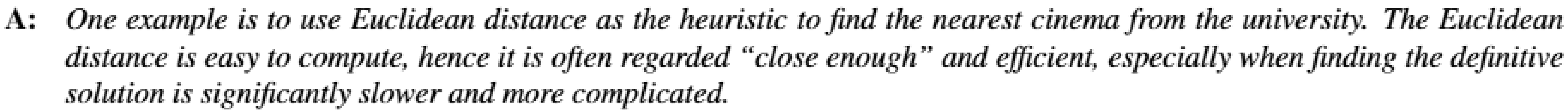
Answers:

(a)



A: *Exact approach. This is an example of a brute-force strategy, in which all possible answers are generated and tested to find the result.*

(b)



A: *One example is to use Euclidean distance as the heuristic to find the nearest cinema from the university. The Euclidean distance is easy to compute, hence it is often regarded "close enough" and efficient, especially when finding the definitive solution is significantly slower and more complicated.*

That's it, thank you for the Semester! ^_^

- **Final due date:**
  - Final exam worth **50%** of your grade on **24 June, 12.30pm**.
    - Please see **my.unimelb.edu.au** for more details.
  - **If you don't sit the exam**, you will **FAIL** the subject due to the hurdle requirement **(30/60 for the MST + Final Exam combined)**.
  - All the best with your exam(s) and future endeavors!

Scan here for annotated slides