Please answer the following questions. **Pay attention to the word limits, which will be strictly enforced.** Also, please ensure that you are in compliance with the course collaboration & plagiarism policy: “All work submitted should be exclusively your own ... You may discuss homework questions verbally, but you may not share any written documents pertaining to homework questions, including emails, draft answers, etc. ... If you use ideas from someone else, you should cite a source. If you use someone else’s words, you should indicate this by using a quotation and citing a source.” As always, you should also ensure that you are in compliance with Stanford’s general plagiarism policy, linked here.

1. **(150 words or less)** Why did Descartes think that animal and human bodies were machines? Why did he think that the human mind was not? What does this imply about the reach of scientific explanation in accounting for the workings of minds and bodies?

2. **(150 words or less)** Using the examples in the lecture slides as a guide, write a context-free grammar that generates the two possible structures for Tommy Cooper’s punchline “I opened the door in my pants”. Describe, as carefully as you can, the key difference between the two structures.

3. **(50 words or less)** This aim of this question and the next is for you to think about what is required to give a completely specified set of instructions. Consider the map of Romania we discussed in class (taken from the popular AI textbook by Russell & Norvig):

Imagine that you are in Eforie, and you need to give instructions to an automated car, to go from there to Zerind. The car understands English, and can find its way from city A to city
if there are no cities in between. But when it is in a given city, it needs to know which
neighboring city to aim for next. Give the car instructions, in English, that it can use to
navigate its entire journey. And make sure the path you instruct it to take is the shortest
possible path to Zerind. (Note: this is not a trick question; it should be very straightforward.)

4. (200 words or less) Just as in question 3, imagine you are trying to instruct an automated
car to go from Bucharest to Arad. However, there is now a twist. Some of the roads between
cities may be closed on account of ice. You are not sure which roads are closed, but you do
know there is some path (sequence of connected cities) that goes from Bucharest to Arad.
Give the car instructions, but this time make sure that the car knows what to do if it reaches
an impasse and must return to the city from where it most recently departed. Try to write
your directions so that the car makes the shortest trip possible, given the circumstances.

5. (150 words or less) Consider the Turing Machine below, on an initial tape that looks like:

```
... 0 0 1 1 1 0 0 ...
```

<table>
<thead>
<tr>
<th></th>
<th>0</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1R3</td>
<td>1R1</td>
</tr>
<tr>
<td>2</td>
<td>1R2</td>
<td>1L3</td>
</tr>
<tr>
<td>3</td>
<td>1R2</td>
<td>0L1</td>
</tr>
</tbody>
</table>

Does this machine ever halt on this input? If it does, what function does it compute (if any)?
If not, how would you describe what it does?

6. (150 words or less) In your own words, explain what a universal Turing machine does.

7. (Extended Response, 500 words or less) Your friend has just read an article that claims a
computer program has finally passed the Turing test and that this means computers are now
just as intelligent as humans. However, your friend hasn’t taken Symsys 100 and doesn’t
know what the Turing test is. First, explain what the Turing test is to your friend in your
own words. (Note: the Turing test is not the same thing as the Loebner Prize, which is
fairly uninteresting for the purpose of this question.) Second, explain whether you agree
or disagree with the claim that a computer program passing the Turing test shows that
computers are now as intelligent as humans.