8 Natural Language Processing (SHT)

The following shows a simple context free grammar (CFG) for a fragment of English:

```
S -> NP VP          NP -> Sandy
VP -> V NP          Det -> a
VP -> V NP NP       N -> puppy
VP -> V NP PP       N -> garden
VP -> VP PP         V -> walks
NP -> Det N         V -> gives
PP -> P NP          P -> to
NP -> Kim           P -> in
```

(*a*) Give all analyses (parse trees) this grammar assigns to the following sentences:

> Kim gives a puppy to Sandy.
> Kim walks a puppy in a garden.

Which of the analyses is correct?   [6 marks]

(*b*) The example sentences in (*a*) illustrate a type of ambiguity common in natural languages. Characterise it, and explain how it arises.   [4 marks]

(*c*) Indicate at least two (other) sources of incorrect analyses in the above grammar, illustrating them with the corresponding ungrammatical sentences. Explain what causes the incorrect analysis.   [4 marks]

(*d*) The incorrect analyses in (*a*) could be avoided using an appropriate feature structure based grammar. Describe the exact mechanism for how this can be done. Does this treatment also deal with your incorrect analyses in (*c*)?
[6 marks]