Exercise 7.1

Suppose we are working with the following DCG:

```
s --> foo,bar,wiggle.

foo --> [choo].

foo --> foo,foo.

bar --> mar,zar.

mar --> me,my.

me --> [i].

my --> [am].

zar --> blar,car.

blar --> [a].

car --> [train].

wiggle --> [toot].

wiggle --> wiggle,wiggle.
```

Write down the ordinary Prolog rules that correspond to these DCG rules.

```
s(X,A) :- foo(X,Y), bar(Y,Z), wiggle(Z,A).

foo([choo|W],W).

foo(X,Z) :- foo(X,Y), foo(Y,Z).

bar(X,Z) :- mar(X,Y), zar(Y,Z).

mar(X,Z) :- me(X,Y), my(Y,Z).

me([i|W],W).

my([am|W],W).

zar(X,Z) :- blar(X,Y), car(Y,Z).

blar([a|W],W).

car([train|W],W).

wiggle([toot|W],W).

wiggle(X,Z) :- wiggle(X,Y), wiggle(Y,Z).
```

What are the first three responses that Prolog gives to the query s(X,[])?

```
X = [choo, i, am, a, train, toot]

X = [choo, i, am, a, train, toot, toot]

X = [choo, i, am, a, train, toot, toot, toot]
```

Exercise 7.2

The formal language $a^n b^n$ - $\{\varepsilon\}$ consists of all the strings in $a^n b^n$ except the empty string. Write a DCG that generates this language.

```
s --> a,b.

s --> a,s,b.


a --> [a].

b --> [b].
```

Exercise 7.3

Let $a^n b^{2n}$ be the formal language which contains all strings of the following form: an unbroken block of as of length n followed by an unbroken block of bs of length $2n$, and nothing else. For example, *abb*, *aabbbb*, and *aaabbbbbb* belong to $a^n b^{2n}$, and so does the empty string. Write a DCG that generates this language.

```
s --> [].

s --> a,s,b.


a --> [a].

b --> [b,b].
```