Units 12, 13
Programming Languages

1. Consider the following grammar, where capital symbols are non-terminals, bolded words are terminals, '|' means or, and S is the starting symbol.

S is the starting symbol and bold symbols are terminals:

S → P C | P A C | P C C
A → **shall** | **might** | **have** | **shall have**
P → **i** | **you** | P C
C → **worked hard** | **pass** | **fail**

   (a) Is "you might have pass" valid? Draw a parse tree if yes; reason your answer if no.
   (b) Is "i worked hard shall pass" valid? Draw a parse tree if yes; reason your answer if no.
   (c) Is this grammar ambiguous?

2. What are encapsulation and polymorphism?

3. Write a prolog program "*f*(*N*, *SSUM*)" to compute $SSUM = 1^2 + 2^2 + ... + N^2$.
   The desired output would be as follows:

```
?- f(5, W).
W=55?
yes
```