CS 237: Concepts of Programming Languages.

Project Part 1: Pascal.

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1.1 describe Pascal grammar and compare it with C grammar .

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| --- | --- | --- |
| Grammar | In C | In Pascal |
| Variable Declaration | type variable\_list;  for example :  int i, j, k; | var  variable\_list : type;  for example :  var  age, weekdays : integer; |
| DecisionMaking | if(boolean\_expression)  statement;  else  statement;  for example :  if( a < 20 )  printf("a is less than 20\n" );  else  printf("a is not less than 20\n"); | if condition then  statement 1  else  statement 2;  for example :  if( a < 20 ) then  writeln('a is less than 20' )  else  writeln('a is not less than 20'); |
| Loops | while(condition) {  statement(s);  }  For example :  int main () {  int a = 10;  while( a < 20 ) {  printf("value of a: %d\n", a);  a++; } return 0; } | while (condition) do  statement;  For example :  while number>0 do  begin  sum := sum + number;  number := number - 2;  end; |
| Defininga Function | return\_type function\_name( parameter list ) {  body of the function  }  For example :  int max(int num1, int num2) {  int result;  if (num1 > num2)  result = num1;  else  result = num2;    return result; } | function name(argument(s):type1; argument(s): type2; ...): function\_type;  local declarations;  begin  < statements >  name:= expression; end;  for example : function max(num1, num2: integer): integer;  var result: integer;  begin if (num1 > num2) then  result := num1  else  result := num2;  max := result; end; |

|  |  |  |
| --- | --- | --- |
| grammar | In C | In Pascal |
| Declaring Arrays | type arrayName [ arraySize ] ;  for example :  double balance[10]; | var  array-name: array[index-type] of element-type ;  for example :  var  n: array [1..10] of integer; |

1.2 give a general program skeleton in Pascal .

program {name of the program}

uses {comma delimited names of libraries you use}

var {global variable declaration block}

function {function declarations, if any}

{ local variables }

Begin

...

end;

procedure { procedure declarations, if any}

{ local variables }

begin

...

end;

var

begin { main program block starts}

...end. { the end of main program block }

1.3- Give examples for the main features of the language (function, procedure, parameter passing (by value and by reference), forward declaration, recursion, and array…).

1.4- Control statements (for, if, while, repeat, case…) should be described and used.

1.5- Run some simple programs using the features describes in 3 using a Pascal programming environment.

**-** Passing by reference

And value with procedure:

program passing\_by\_reference\_and\_value\_with\_procedure;

var

x:integer;

procedure mulByValue(x:integer); {passing by value}

begin

writeln('Passing by value ..');

x:= x\*x;

end;

procedure mulByReference(var x:integer); {passing by reference}

begin

writeln('Passing by reference ..');

x:= x\*x;

end;

begin

writeln ('Enter an integer to find it’s square :');

readln(x);

mulByValue(x);

writeln(x); {outputs 5}

mulByReference(x); {outputs 25}

Output:

writeln(x);

Enter an integer to find its square :

4

Passing by value ..

4

Passing by reference ..

16

readln;

end.

**-**forward declaration:

Program forward;

Procedure First; forward;

Procedure Second;

begin

WriteLn('In second. Calling first...');

First;

end;

Procedure First;

begin

WriteLn('In first');

end;

Output:

begin

In second. Calling first...

In first

Second;

readln;

end.

**-**recursion:

program recursion;

var

x:integer;

function factorial (x:integer):integer;

begin

if(x=1)or(x=0)then

factorial:=1

else

factorial:=x\*factorial(x-1);

end;

begin

write('Enter the number to see the factorial : ');

readln(x);

writeln(factorial(x));

readln;

Output:

end.

Enter the number to see the factorial :

5

120

**-** if else:

Program if\_else;

uses crt;

var x:integer;

begin

writeln('Enter number that is positive or negative');

readln(x);

if x > 0 then

writeln(x,' is positive number ')

Output:

else if x < 0 then

Enter any number

-3

3 is negative number

writeln(x,' is negative number ')

else

writeln('it/'s 0');

read;

end.

**-** for and while:

program for\_and\_while;

var

number:array[1..3] of integer;

x:integer;

y:integer=1;

sum:integer=0;

begin

writeln('Enter 3 integer to get the sum: ');

for x:=1 to 3 do

Output:

readln(number[x]);

Enter 3 integer to get the sum:

3

4

2

the sum is = 9

while y <= 3 do

begin

sum := sum + number[y];

y:= y+1;

end;

writeln('the sum is = ',sum );

readln;

end.

**-** if-else:

program repeat\_and\_if;

var

x,y:integer;

begin

writeln('enter two numbers to find the greatest value');

readln(x,y);

if x > y then

Output:

writeln(x,' is greater than ',y )

enter two positive numbers to show the greatest value

4

7

7 is greater than 4

else if y > x then

writeln(y,' is greater than ',x)

else

writeln(x,' equle ',y);

readln;

end.

**-** Case:

program case\_;

var

mark:integer;

begin

writeln('enter the mark from 1 to 100 to show the grade :');

readln(mark);

case mark of

0..59 : writeln('F');

60..69: writeln ('D');

70..79: writeln ('C');

80..89:writeln ('B');

Output:

90..100:writeln ('A');

end;

enter the mark from 1 to 100 to show the grade :

99

A

if(mark>100)then

writeln('Invalid input!');

if(mark<0)then

writeln('Invalid input!');

readln; end.

Part 2: scheme.

2.1- Study more predefined function in addition to those studied in course.

2.2- Run some simple programs using the Scheme programming environment given in the website.

**A- 2.1**

What are Lists ?

Lists are the basic structured data type in Scheme.

**- some list handling functions in Scheme:**

-cons:

takes two arguments and returns a pair (list).

-car:

returns the first member of a list or dotted pair.

-cdr:

returns the list without its first item, or the second member of a dotted pair.

-null?:

returns #t if the object is the null list and It returns () if the object is

anything else.

-list:

returns a list constructed from its arguments.

-length:

returns the length of a list.

-reverse:

returns the list reversed.

-append:

returns the concatenation of two lists.

**A- 2.2**

(car '(da fa f)) **---🡪** 'da

(cons '(j k) '(g a f)) **---**🡪 '((j k) g a f)

(cdr '(adss fe ge eq)) **---**🡪 '(fe ge eq)

(null? '()) **---🡪** #t

(null? '(s)) **---🡪** #f

(list 'd 'a '(a fg)) **---🡪** '(d a (a fg))

(list '(a r) 'h) **---🡪** '((a r) h)

(length '(4 51 12 4)) **---🡪** 4

(reverse '(a b c d)) **---🡪** '(d c b a)

(append '(ad (f a) r) '(q w)) **---🡪** '(ad (f a) r q w)

(append 'a) **---🡪** 'a

(define (is\_even? a)(even? a)) **---🡪** (is\_even? 5) **---🡪** #f

((lambda (l) (car(car l))) '((a b) cd)) **---🡪** 'a

- this program will find the greatest number

(define (max? a b)

(cond

((> a b) (display "the maximum number is ")(display a))

((> b a) (display "the maximum number is ")(display b))

(else (display "numbers are equal"))

)

)

> (max? 6 5)

the maximum number is 6

Output:

Part 3: prolog

3.1- Translate most of the functions seen in Pascal, Scheme to Prolog.

3.2- Run these programs using the Prolog programming environment given in the website.

- This program get the factorial of a number.

fact(0, 1).

fact(X, Y):-X > 0 ,X1 is X-1,fact(X1,Y1),

Y is X\*Y1.

?- fact(5,R).

Output:

R = 120

- This program lists all items in a list.

list\_items([]).

list\_items([X|R]):- write(X),nl,list\_items(R).

?- list\_items([5,4,3,2,1]).

Output:

5

4

3

2

1

true

- This program reverses a list.

reverse(List, Reversed) :-

reverse(List, [], Reversed).

reverse([], Reversed, Reversed).

reverse([Head|Tail], SoFar, Reversed) :-

reverse(Tail, [Head|SoFar], Reversed).

?-reverse([a,b,c,d],X).

Output:

X = [d, c, b, a]

- This program checks if an atom is in the list or not.

member(X,[X|\_]).

member(X,[\_|T]):- member(X,T).

?-member(1,[2,4,7,0]).

false

Output:

-This program adds a prefix or suffix to a given word.

put\_prefix(P,C,R):- name(P,Pcode),name(C,Ccode),

append(Pcode,Ccode,Rcode),

name(R,Rcode).

put\_suffix(S,C,R):- name(S,Scode),name(C,Ccode),

append(Ccode,Scode,Rcode),

name(R,Rcode).

R= unused

Output:

?-put\_prefix(un,used,R).

- This program finds the nth element of a list.

nth(0,[X|\_],X).

nth(N,[\_|T],R):- M is N-1,nth(M,T,R).

?- nth(2,[a,b,c,d],R).

R= c

Output: