Chow Sai Yat Morri
SID: 54796760
MS4262 Advanced Analytics using SAS

SAS code (Tower of Hanoi)

```
%macro TOWER(X);
	%let y=%eval(2**&X-1); /*Create general formula for calculating the total steps*/
	data game (drop= last i j); /*Drop unwanted variables*/

		array a{&X,&Y} _Temporary_; /*Create a 2D array for the game (&X: No.of
diskes,&Y: Steps)*/

		a{1,1}=1; /*Step for 1 disk (initial value)*/
		last=1; /*Assigning ending position*/

		if &X>1 then do; /*Input values for X diskes*/
			do i=2 to &X; /*loop for row*/
			do j=1 to last; /*loop for column*/
			a{i,j}=a{i-1,j}; /*Reuse the values of previous row as the beginning
steps*/
			a{i,last+1}=i; /*Insert existing disk as the middle step*/
			a{i,last+1+j}=a{i-1,j}; /*Reuse the values of  previous row as the
ending steps*/
			end;

			last=last*2+1;/*Assign new ending position for further calculation*/
			end;
		end;

		count=1; /*initial count for the step*/
		%hanoi(&X,1,2,3); /*Input desirable values for the defined macro hanoi*/
	run;
%mend;



%macro transfer(one,three); /*Record the movement*/
	if (&three)=1 then  rod1=a{&X,count};
	else if (&three)=2 then  rod2=a{&X,count};
	else  rod3=a{&X,count};
	output;
/*Initialize rod1-rod3*/
	rod1=.;
	rod2=.;
	rod3=.;
	count+1; /*Record each step*/
%mend;
```

```
%macro hanoi(n,one,two,three);
        %if &n=1 %then %do; /*Return to transfer macro to start moving*/
                %transfer(&one,&three);
        %end;
        %else %do; /*Moving process*/
                %hanoi(%eval(&n-1),&one,&three,&two); /*rod2<--->rod3*/
                %transfer(&one,&three);
                %hanoi(%eval(&n-1),&two,&one,&three); /*rod1<--->rod2*/
        %end;
%mend;

%TOWER(4) /*Call macro TOWER and run the program when disk number =4*/
```

Output for 5 diskes

Total rows: 15 Total columns: 4

	count	rod1	rod2	rod3
1	1	.	1	.
2	2	.	.	2
3	3	.	.	1
4	4	.	3	.
5	5	1	.	.
6	6	.	2	.
7	7	.	1	.
8	8	.	.	4
9	9	.	.	1
10	10	2	.	.
11	11	1	.	.
12	12	.	.	3
13	13	.	1	.
14	14	.	.	2
15	15	.	.	1