**Exercises for unit 03 Surface representations**

1.

Define Surface Representation for a pyramid with triangular base. When specifying the Edge Table and the Surface Table ensure that when the cut-out below is folded into the pyramid the triangle surfaces face correctly "in" and "out". Labels v1-v6 are vertex numbers, to be used in the construction of the Tables.

Solution

| Vertex table	Edge Table			Surface table		
v1	E1	v1	v2	S1	E1, E2, E3	
v2	E2	v2	v3	S2	E4, E5, -E2	note '-'
v3	E3	v3	v1	S3	E6, -E3, -E5	note '-'
v4	E4	v2	v4	S4	-E1, -E4, -E6	note '-'
	E5	v4	v3			
	E6	v4	v1			

Comments:

- Only 4 vertices are needed

- The correct in-out surface orientation is only possible if we reverse direction of a number of edges. Observe that if two triangles share an edge, when traversing vertices in anti-clockwise direction the shared edge will have the opposite "direction" for each of the triangles. See how this problem is solved for Java StripArray structures.
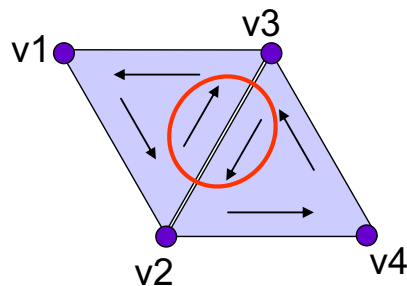
2.

Define Surface Representation for "Big N" in a Cartesian left-handed local coordinate system using rectangles shown in the figure below.
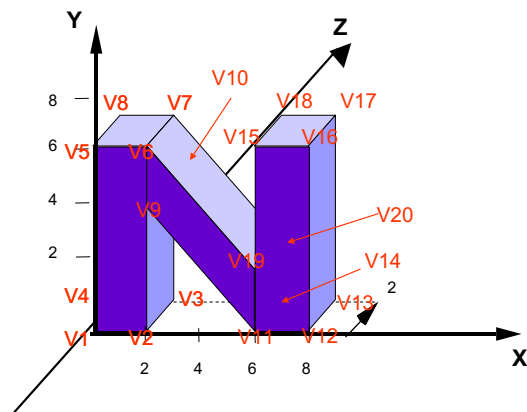
Vertex table

V	x	y	z
1	0	0	0
2	2	0	0
3	2	0	2
4	0	0	2
5	0	6	0
6	2	6	0
7	2	6	2
8	0	6	2
9	2	3.17	0
10	2	3.17	2
11	6	0	0
12	8	0	0
13	8	0	2
14	6	0	2
15	6	6	0
16	8	6	0
17	8	6	2
18	6	6	2
19	6	2.83	0
20	6	2.83	2

Edge table

	V1	V2	E
base1	1	2	1
	2	3	2
	3	4	3
	4	1	4
top1	5	6	5
	6	7	6
	7	8	7

	8	5	8
base2	11	12	9
	12	13	10
	13	14	11
	14	11	12
top2	15	16	13
	16	17	14
	17	18	15
	18	15	16
leg1	1	5	17
	2	9	18
	3	10	19
	4	8	20
leg2	19	15	21
	12	16	22
	13	17	23
	20	18	24
cross	5	11	25
	6	12	26
	7	13	27
	8	14	28

Surface table

S	E
base1	1,4,3,2
top1	5,6,7,8
base2	11,14,13,12
top2	15,16,17,18
leg1	1,2,6,5
	2,3,10,9
	3,4,8,7
	1,4,8,5
leg2	11,12,16,15
	12.13.17.16
	13,14,18,17
	15,18,20,19
cross	6,19,11,9
	6,19,20,7
	7,20,14,10
	9,10,14,11