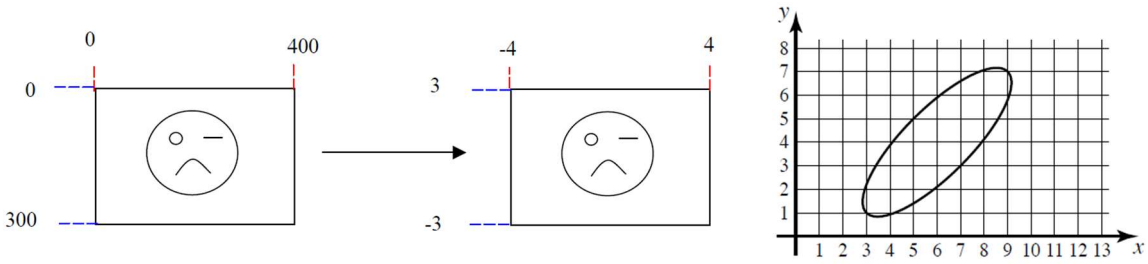
1. (transformation)

(1) Give a transformation that maps the 400 x 300 viewport shown below left to the 8 x 6 window shown on the right (Note the order reversal along the y-axis). You may express your transformation either in equation form or as a 3 x 3 homogeneous matrix. (10 pts)

(2) The unit circle may be represented parametrically as $\left\{\left[\cos t,\ \sin t\right]^T \middle| t \in \left[0, 2\pi\right]\right\}$. Give a parametric representation for the ellipse shown here. Make use of transformations to keep your expression simple. Write your answer as a product of several matrices. (10 pts)




2. (projections) Your answers should be 4 x 4 matrices in homogeneous coordinates.

(1) Give the perspective projection matrix with the center of projection at x = 0; y = 0; z = d and the projection plane z = 0. Draw a picture to aid your reasoning. (10 pts)

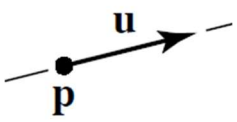
(2) Give the orthogonal projection matrix onto the plane z = 0 and verify that we obtain the orthogonal projection matrix as the limit of the perspective projection matrix as d goes to infinity. (5 pts)

3. An infinite line is represented parametrically as $\mathbf{L} = \left\{\mathbf{p} + t\mathbf{u} \middle| t \in \mathbb{R}\right\}$. Let $\mathbf{T}(\mathbf{x}) = \mathbf{M}\mathbf{x} + \mathbf{w}$. What is the parametric representation of $\mathbf{T}(\mathbf{L})$? (5 pts)

4. half edge data structure와 winged edge structure를 비교하여 설명하시오. (5 pts)

5. 직사각형과 원 primitive만을 이용하여 아래 형상을 CSG로 모델링하려고 한다. 최소 수의 요소와 Boolean 연산으로 CSG tree를 그리시오. (좌표변환은 무시) (5 pts)

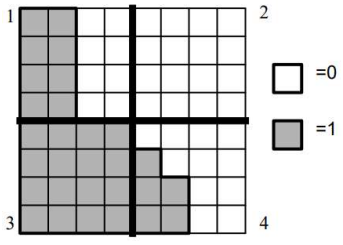
6. 아래 형상을 표현하는 QUAD-TREE를 그리시오. (tree에서 각 node는 좌에서 우로 {1, 2, 3, 4} 순서로 기재) (5 pts)




Problem 3

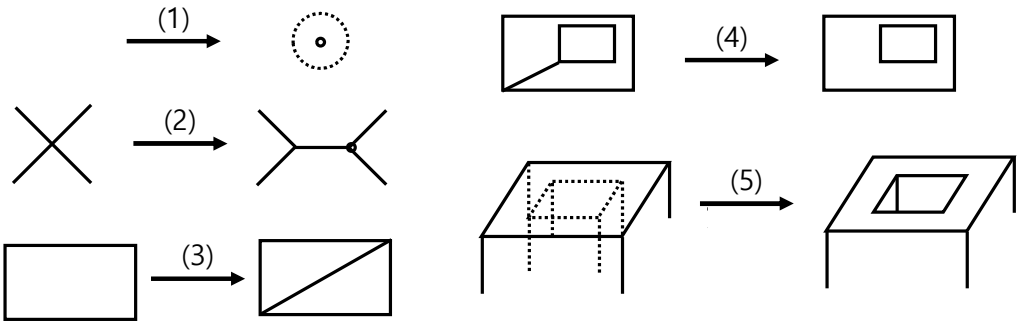


Problem 5



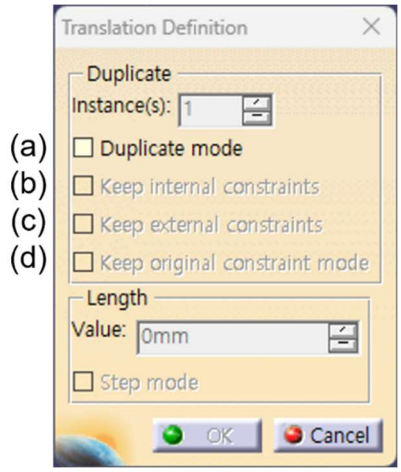

Problem 6

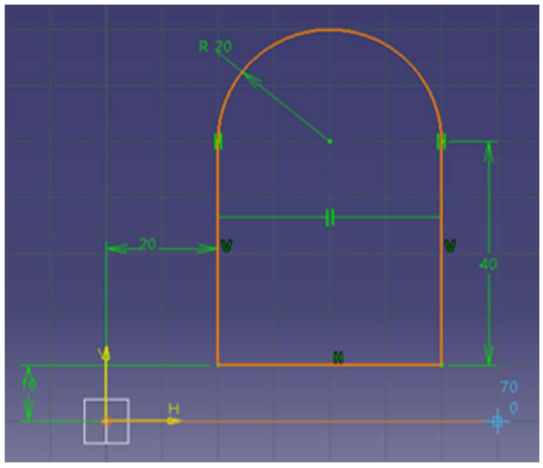
7. 아래 그림의 Euler operation 의 명칭과 기능을 설명하시오. (10 pts)




8. (10 pts) (1) Sketcher workbench에서 Translate 기능을 사용할 때, (a)~(d)의 정확한 기능을 설명하시오.

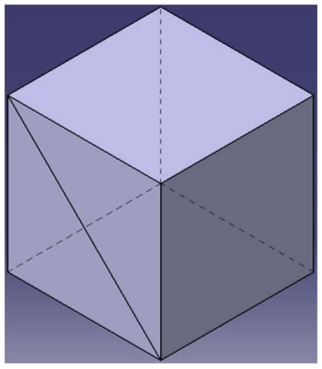
(2) 아래 선택된 Profile을 H방향으로 +70만큼 Translate 기능을 사용할 때, (a)~(b), (a)~(c), (a)~(d)가 적용된 결과를 각각 도시하시오.

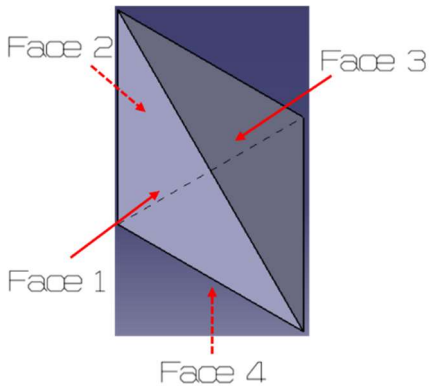


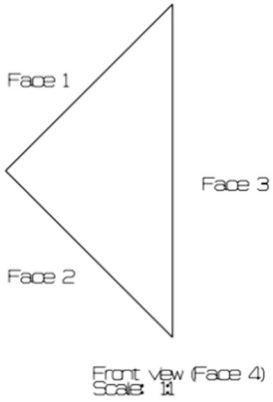




9. (10 pts) Part Design 에서 Tritangent Fillet 기능을 정육면체의 꼭지점으로 구성된 삼각뿔에 적용할 때, Front View 의 개형을 도시하시오.

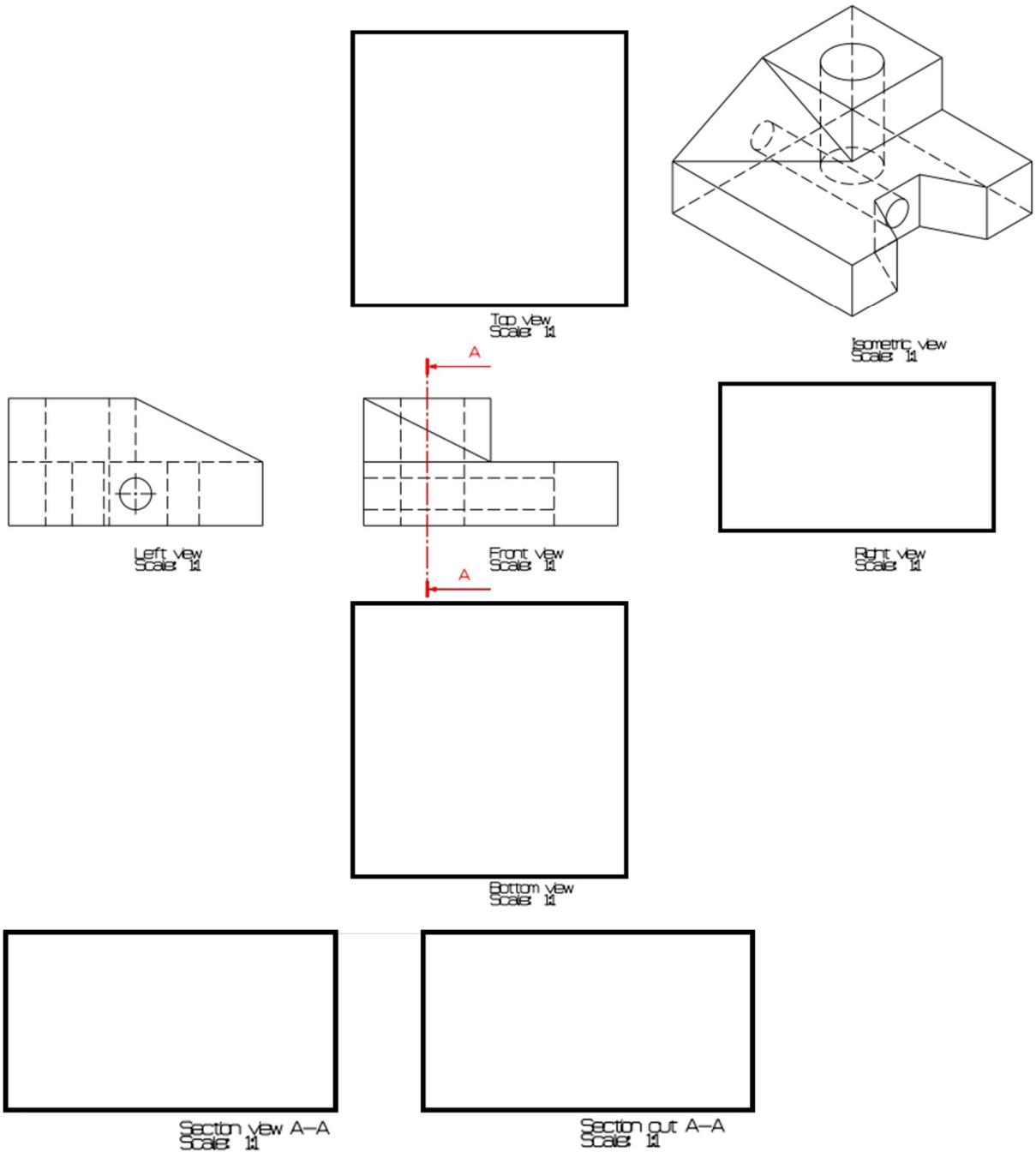
(1) Face to fillet: Face1, Face2 / Face to remove: Face3 (2) Face to fillet: Face2, Face3 / Face to remove: Face1



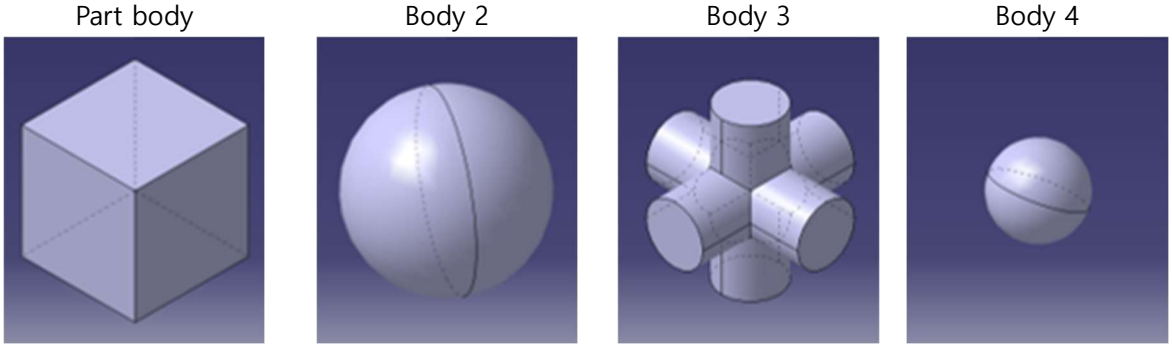


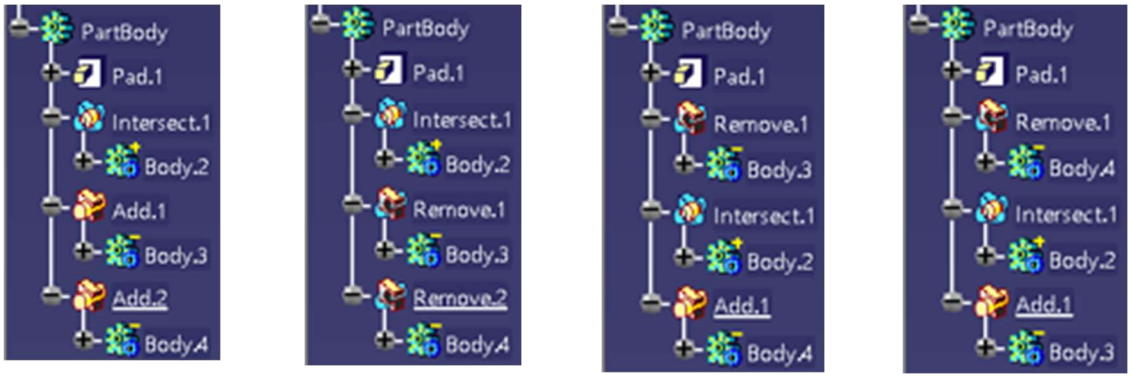



10. 아래 주어진 3차원 모델의 정면도와 등각투상도를 보고 제 3각법을 적용하여 Top view, Bottom view, Right veiw와 단면도(section view, section cut) 결과를 도시하시오 (hidden line, center line 모두 표시할 것) (10 pts)



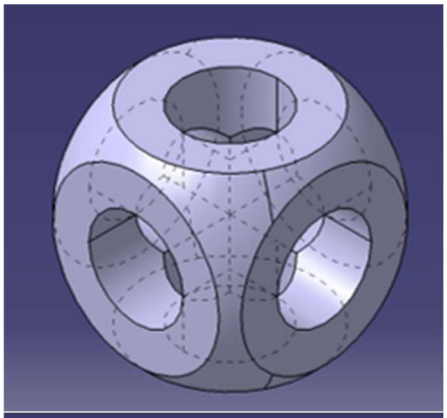
11. Part Design에서 네 개의 Body가 다음과 같이 구성되어 있을 때, 각 작업트리에 맞는 결과를 찾으시오. (10 pts)



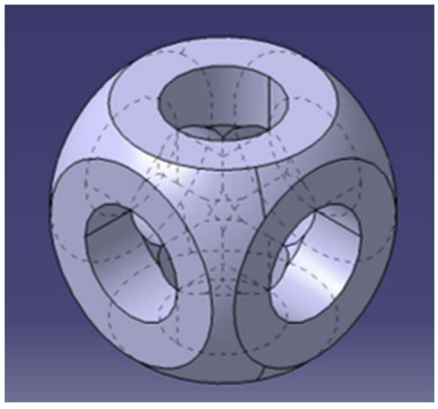




(1) (2) (3) (4)

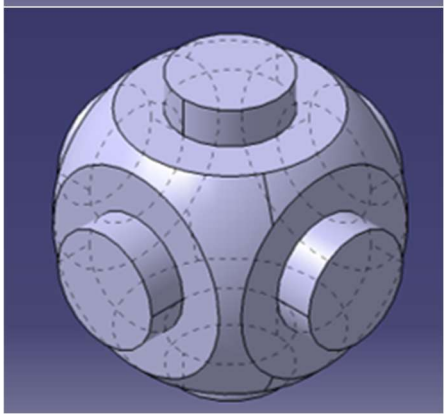
(a)



(b)



(c)



(d)