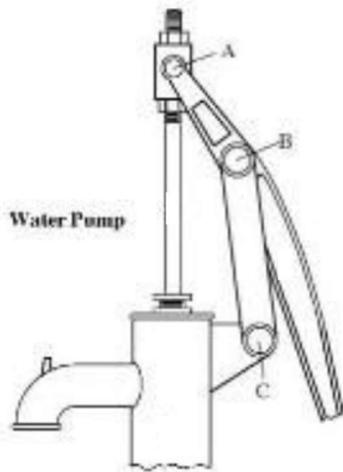


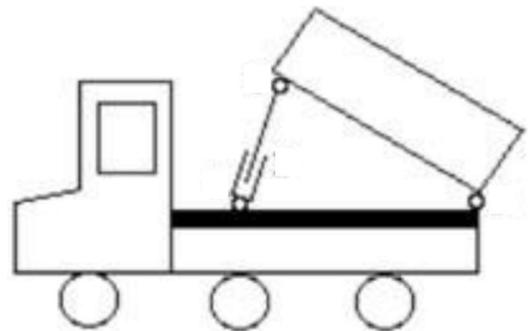
1. ISO/ASTM 정의에 따라 아래 그림에 해당하는 additive manufacturing 공정 7 가지와 해당되는 대표 방법을 기입하시오. (각 2 점)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Scheme							
Process	Layer by layer deposition of molten material	Selective curing of photo-curable material in a liquid container	Material deposition and subsequent curing	Selective dispense of binder for joining powder in a bed	Fusing of powder in a bed by melting the selected region	Direct fusion of the material	Bonding of individual sheets of material
Name	(8)	(9)	DOD MJ NPJ	BJ	(10)	LENS EBAM DMT	LOM UC

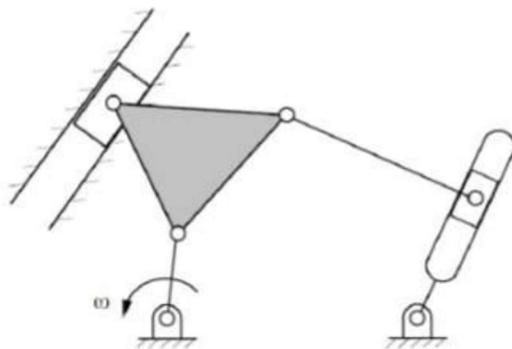
2. Determine the number of degrees of freedom, using Gruebler's equation, for the mechanisms. (link, joint 설명 없으면 0 점) (각 5 점)



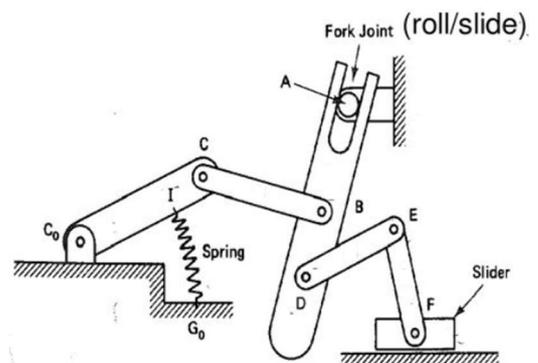
(1)



(2)

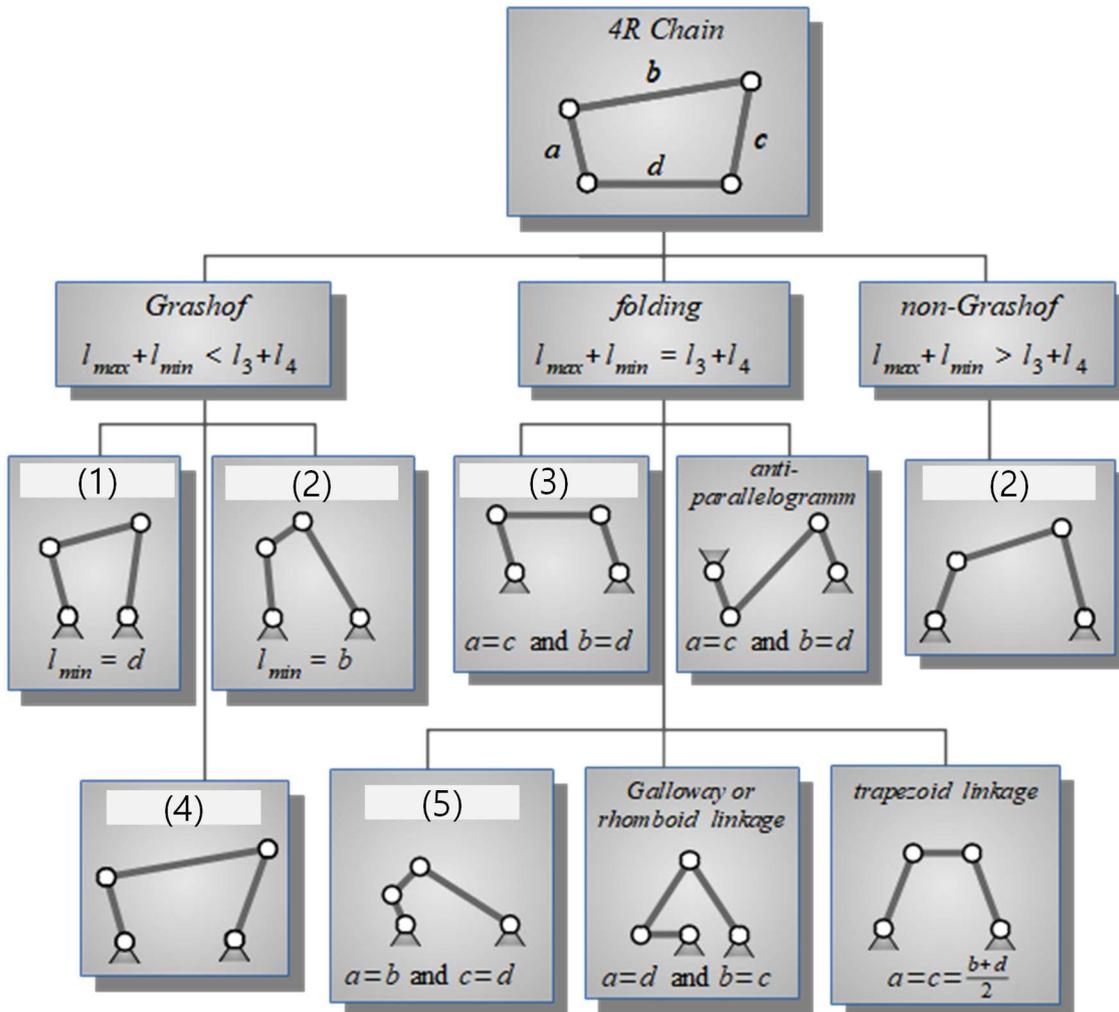


(3)



(4)

3. Four-bar linkages can be classified regarding Grashof's rule as shown in the figure. Fill in the blank with the type of motion. (각 2 점)



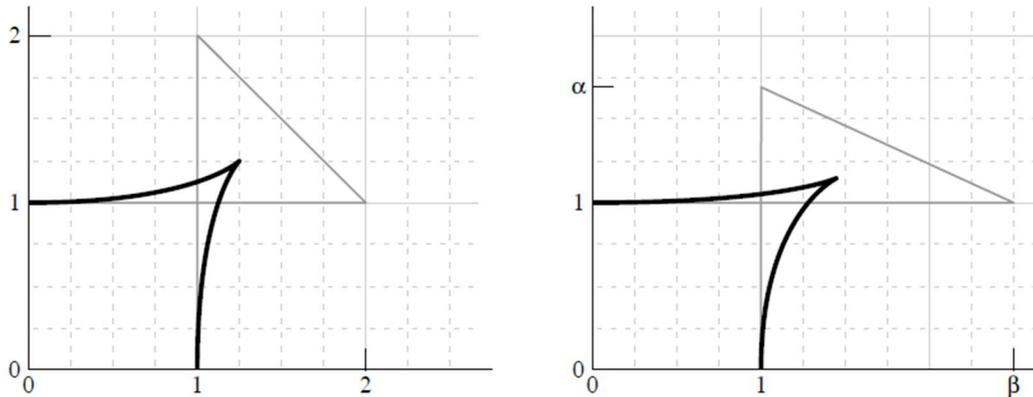
4. The curve is given by $\mathbf{P}(t) = (1-t)^3 \mathbf{P}_0 + 2t(1-t)\mathbf{P}_1 + t(1-t)\mathbf{P}_2 + t^3\mathbf{P}_3$. (15 점)

- (1) Does this curve interpolate the endpoints? Why or why not?
- (2) Is this curve symmetric? Why or why not?
- (3) Is this curve coordinate system independent? Why or why not?

5. Convert the power basis rational curve $x = \frac{2t^2}{t^2+1}, y = \frac{(t+1)^2}{t^2+1}$ to rational Bézier form. That is, find the

control points and weights for the equivalent rational Bézier curve. (20 점)

6. A Bézier spline with the control points $(1, 0)$, $(1, \alpha)$, $(\beta, 1)$, $(0, 1)$ will form a cusp when $\alpha = \beta = 2$, but for many other values of α it is also possible to find β for which a cusp will form.



(1) Let t_x and t_y be the values of t at which $x'(t) = 0$ and $y'(t) = 0$ respectively. Find an expression for t_x as

a function of β . (10 점)

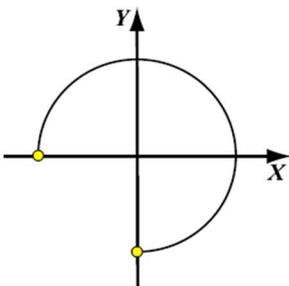
(2) Use a simple symmetry argument to get t_y as a function of α , and then use your two functions to eliminate

t and find β as a function of α . (10 점)

(3) Check your answer: make sure it works for $\alpha = 2$. (5 점)

7. Define a NURBS curve of three quarters of a complete circle of radius 1 as shown below. More precisely, the center is at the origin, the beginning point of this 3-quarter circle is $(0, -1)$ and the ending point is $(-1, 0)$.

(10 점)



$$B_i^n(u) = \binom{n}{i} (1-u)^{n-i} u^i = \frac{n!}{i!(n-i)!} (1-u)^{n-i} u^i$$

[Cox-de Boor (blending) function]

$$N_{i,l}(u) = \begin{cases} 1 & \text{if } t_i \leq u < t_{i+1} \\ 0 & \text{otherwise} \end{cases}, N_{i,k}(u) = \frac{(u-t_i)}{t_{i+k-1}-t_i} N_{i,k-1}(u) + \frac{(t_{i+k}-u)}{t_{i+k}-t_{i+1}} N_{i+1,k-1}(u)$$

8. Assembly 에서 그림과 같이 모델을 조립했을 때, 아래 질문에 답하시오.



- (1) Flexible-Rigid Sub-Assembly 기능에 대해 설명하고, SubProduct 모델에 적용했을 때와 적용하지 않았을 때의 차이를 그림으로 표현하시오. (5 점)
- (2) 아래 두 기능을 이용하여 조립 모델의 완성도를 평가하고자 할 때, 가능한 방법을 각각 서술하시오. (5 점)



Explode



Clash

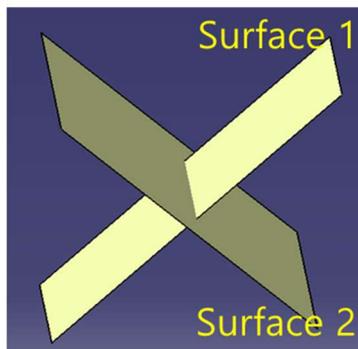
9. Generative Shape Design 에서 다음 두 기능의 차이를 설명하고, 아래 모델을 참조하여 그림으로 표현하시오. (선택 순서: Surface 1 → Surface 2) (10 점)



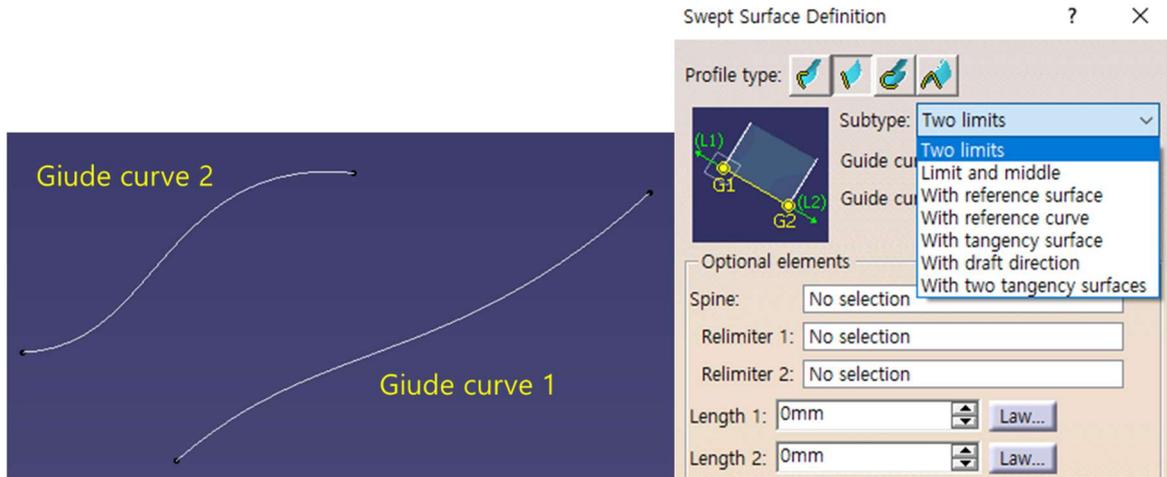
Split



Trim



10. Generative Shape Design 에서 곡면을 제작하기 위해 Sweep 의 Line 기능을 이용하고자 한다. 아래 질문에 답하시오.



(1) Two limits 와 Limit and middle 의 차이를 설명하고 위 예시에 적용했을 때 예상되는 결과 차이를 도시하시오. (선택 순서: Guide curve 1 → Guide curve 2) (5 점)

(2) 위 그림과 같이 두 Guide curve 의 길이가 다른 경우 발생할 수 있는 문제를 작성하고, 이를 해결하기 위한 방법을 기술하시오. (5 점)

11. DMU Kinematics 에서 아래 그림과 같은 운동을 구현하기 위한 과정을 Kinematic joints 를 이용하여 설명하시오. (Pin 1 (1)을 Fix 로 시작, 동력이 작용되는 joint 명시 필수, 부품 간 침투가 안되도록 동작) (10 점)

