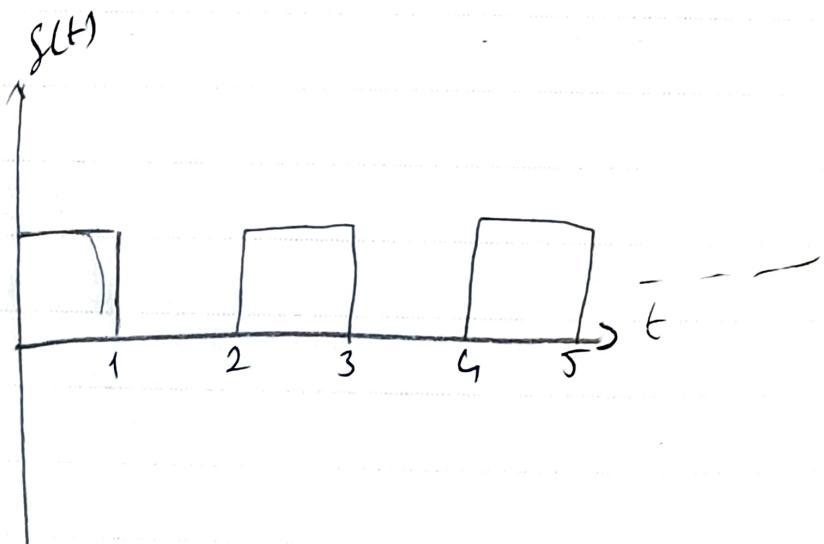
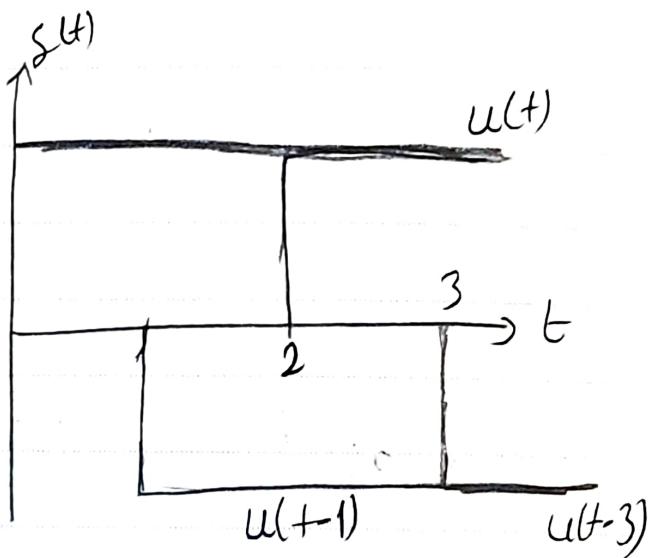


Q6.a

$$S(t) = \sum_{n=0}^{\infty} (-1)^n u(t-n)$$

$$= 1 \cdot u(t) - 1 \cdot u(t-1) + 1 \cdot u(t-2) - u(t-3)$$



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Q6.a

$$\mathcal{L}\{f(t)\} = \sum_{n=0}^{\infty} (-1)^n \mathcal{L}\{u(t-n)\}$$

$$\mathcal{L}\{u(t-n)\} = \frac{e^{-ns}}{s}$$

$$\mathcal{L}\{f(t)\} = \sum_{n=0}^{\infty} (-1)^n \frac{e^{-ns}}{s}$$

$$= \sum_{n=0}^{\infty} \frac{(-1 e^{-s})^n}{s} = \frac{1}{s} \sum_{n=0}^{\infty} (-1 e^{-s})^n$$

$$\boxed{\sum_{n=0}^{\infty} ar^n = \frac{a}{1-r}}$$

$$\frac{1}{s} \cdot \frac{-1}{1 + e^{-s}} = \frac{1}{s(1 + e^{-s})}$$

Q6.b

$$\mathcal{L}^{-1} \left\{ \ln \left(\frac{s^3 + 3s^2 + 2s}{s^2 + 9s + 20} \right) \right\}$$

$$= -\frac{1}{t} \mathcal{L}^{-1} \left\{ \frac{s^3 + 3s^2 + 2s}{s^2 + 9s + 20} \right\}$$

$$\frac{1}{k} \left(\frac{s^3 + 3s^2 + 2s}{s^2 + 9s + 20} \right)' = \frac{[(s^3 + 3s^2 + 2s)'(s^2 + 9s + 20) - (s^3 + 3s^2 + 2s)(s^2 + 9s + 20)']}{(s^2 + 9s + 20)^2}$$

$$\frac{(3s^2 + 6s + 2)(s^2 + 9s + 20) - (2s + 9)(s^3 + 3s^2 + 2s)}{(s^2 + 9s + 20)^2}$$

$$\frac{s^4 + 18s^3 + 85s^2 + 120s + 40}{(s^2 + 9s + 20)^2} \cdot \frac{1}{k}$$

$$= \mathcal{L}^{-1} \left\{ \frac{s^4 + 18s^3 + 85s^2 + 120s + 40}{(s^3 + 3s^2 + 2s)(s^2 + 9s + 20)} \right\}$$

Q 6.b / ...

$$= - \frac{H(t) + e^{-t} + e^{-2t} - e^{-4t} - e^{-5t}}{t}$$