$$\boxed{M_t = e^{\lambda W_t - \alpha t}}$$

Want $E_s M_t = M_s$

Compute $E_s M_t = E_s e^{\lambda W_t - \alpha t} = E_s e^{-\alpha t} E_s e^{\lambda(W_t - W_s + W_s)}$

$$= e^{-\alpha t} E_s \left(e^{\lambda(W_t - W_s)} e^{\lambda W_s} \right)$$

At time $N \rightarrow$ Payoff $g(S_N) = f_N(S_N)$ $\quad (f_N(x) = g(x))$

Compute V_{N-1} : $\boxed{V_{N-1} = \frac{1}{1+r} \tilde{E}_{N-1} V_N} = \frac{1}{1+r} \tilde{E}_{N-1} f_N(S_N)$

$$= \frac{1}{1+r} \tilde{E}_{N-1} f_N(S_{N-1} X_N) \qquad X_N = \begin{cases} u & \text{if } N^{th} \text{ coin} = H \\ d & \text{if } N^{th} \text{ coin} = T \end{cases}$$

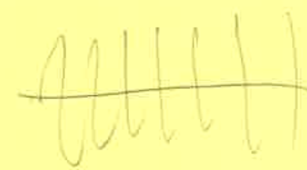
Indep lemma

$$= \frac{1}{1+r} \left[f_N(S_{N-1} u) \tilde{p}_1 + f(S_{N-1} d) \tilde{q}_1 \right] = f_{N-1}(S_{N-1}) \quad f_{N-1}(x)

$$\boxed{f_{N-1}(x) = \frac{1}{1+r}\left[f_N(ux)\,\tilde{p} + f_N(dx)\,\tilde{q} \right]}$$

Continue & write formula for $\boxed{f_n(x) \text{ in terms of } f_{n+1}}$

$$\int_0^T D_t \, dS_t \overset{\text{Rieman Stieltjes}}{=} \boxed{\lim_{\|P\| \to 0}} \sum \boxed{D_{t_i}\left(S_{t_{i+1}} - S_{t_i}\right)}$$



lim exists only if $V_{[0,T]} S < \infty$

$$V_{[0,T]} = \sum \left| S_{t_{i+1}} - S_{t_i} \right|$$

$$E_s M_t = e^{-\alpha t} e^{\lambda W_s} E\, e^{\lambda(W_t - W_s)}$$

$$= \underbrace{e^{\lambda W_s - \alpha s}}_{M_s} \boxed{e^{-\alpha(t-s)} \cdot e^{\frac{\lambda^2}{2}(t-s)}}$$