

**1<sup>st</sup> Question**

$$\Pi = \begin{cases} 0 & \text{if } S_T < 50 \\ 1000 - \max\left(0, 1000 \frac{100 - S_T}{S_T}\right) & \text{if } 50 \leq S_T \leq 100 \\ 1000 & \text{if } S_T > 100 \end{cases}$$

or equivalently

$$\begin{aligned} \Pi &= 1000 - \min \left[ \max \left( 1000, 1000 \frac{100 - S_T}{S_T}, 0 \right) \right] \\ &= 1000 - \frac{1000}{S_T} \min \left[ S_T, \max(100 - S_T, 0) \right] \\ &= 1000 + \frac{1000}{S_T} \max \left[ -S_T, \min(S_T - 100, 0) \right] \\ &= 1000 + \frac{1000}{S_T} \left\{ \max \left[ -S_T - \min(S_T - 100, 0), 0 \right] + \min(S_T - 100, 0) \right\} \\ &= 1000 + \frac{1000}{S_T} \max \left[ \max(100 - S_T, 0) - S_T, 0 \right] + \frac{1000}{S_T} \min(S_T - 100, 0) \\ &= 1000 + \frac{1000}{S_T} \max \left[ \max(100 - 2S_T, -S_T), 0 \right] + \frac{1000}{S_T} \min(S_T - 100, 0) \\ &= 1000 + \frac{1000}{S_T} \max(100 - 2S_T, 0) + \frac{1000}{S_T} \min(S_T - 100, 0) \\ &= \underbrace{1000}_{(B)} + \frac{2000}{S_T} \underbrace{\max(50 - S_T, 0)}_{(LP)} + \frac{1000}{S_T} \underbrace{\min(S_T - 100, 0)}_{(SP)}. \end{aligned}$$

The decomposition in terms of  $(B)$ ,  $(LP)$  and  $(SP)$  clarifies that the ICON combines the payoffs of a regular bond with face value \$1,000 and a bull spread that consists of a long position on a put option to sell \$2,000 at \$50 and a short position on a put option to sell \$1,000 at \$100.

**2<sup>nd</sup> Question = Assignment #2, 3.24****3<sup>rd</sup> Question = Assignment #2, 3.28****4<sup>th</sup> Question = Assignment #2, 3.26**