

# On the pricing of the American Option

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## Abstract

We consider the problem of calculation of an American put option with the payoff function  $f = f_n(x)$  for the financial market  $(B_n, S_n)$ ,  $n = 0, 1, \dots, N$ , of the binomial model by Cox, Ross and Rubinstein. The nonself-financing strategies are considered when a certain sum proportional to the bond and stock-share prices is deposited in the process of investment.

We obtain the capital process in the form

$$X_n = T f_{n+1}(S_n)$$

and the recurrent equation for a fair (rational) option price

$$P_n(x) = \max \{f_n(x), T P_{n+1}(x)\}, \quad n = 0, 1, \dots, N, \quad P_N(x) = f_N(x),$$

where the operator  $T$  is written as

$$Tf(x) = \frac{1 + c_1}{1 + r} [p^* f((1 + b)x) + (1 - p^*) f((1 + a)a)],$$
$$p^* = \frac{r - c_1(1 + a) + c_2(1 + r) - a}{(b - a)(1 + c_1)},$$

and  $r > 0$ ,  $-1 < a < r < b$ , are the market parameters,  $0 < c_1 < 1$ ,  $0 < c_2 < 1$ .

Furthermore, in the case of an seller's and buyer's American put option we have defined an optimal moment of time for the option execution.