11.4 11.5 11.6 Uncertainty and Decisions Over Time - Extensive Form Games Against Nature

Tuesday, November 10, 2020 8:28 PM

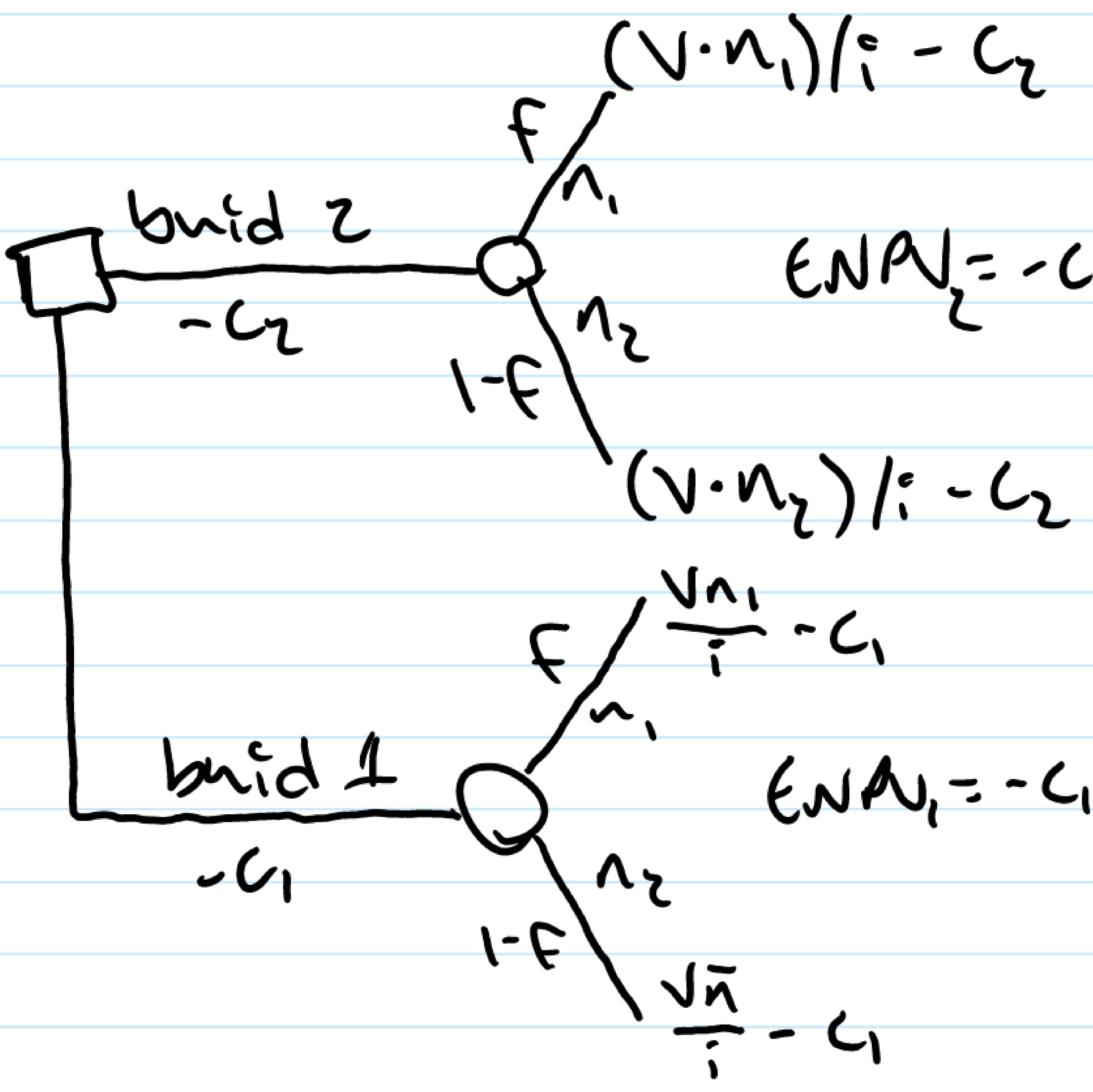
Example → Sports facility
unsure about level of demand
1 or 2 fields

Actions:
Build 1 → maybe another later
Build 2

C_1 = cost to build 1
C_2 = cost to build 2 → $C_2 < 2 \cdot C_1$

$\bar{n}$ = field capacity
v = benefit per user, up to capacity
n = # of users → $0 < n_1 \le \bar{n} \le n_2 \le 2 \cdot \bar{n}$
f = Prob $n = n_1$

Payoff if build 2 or 1 now



$ENPV_2 = -C_2 + \frac{fvn_1}{i} + \frac{(1-f)vn_2}{i}$

$ENPV_1 = -C_1 + \frac{fn_1v}{i} + \frac{(1-f)\bar{n}v}{i}$

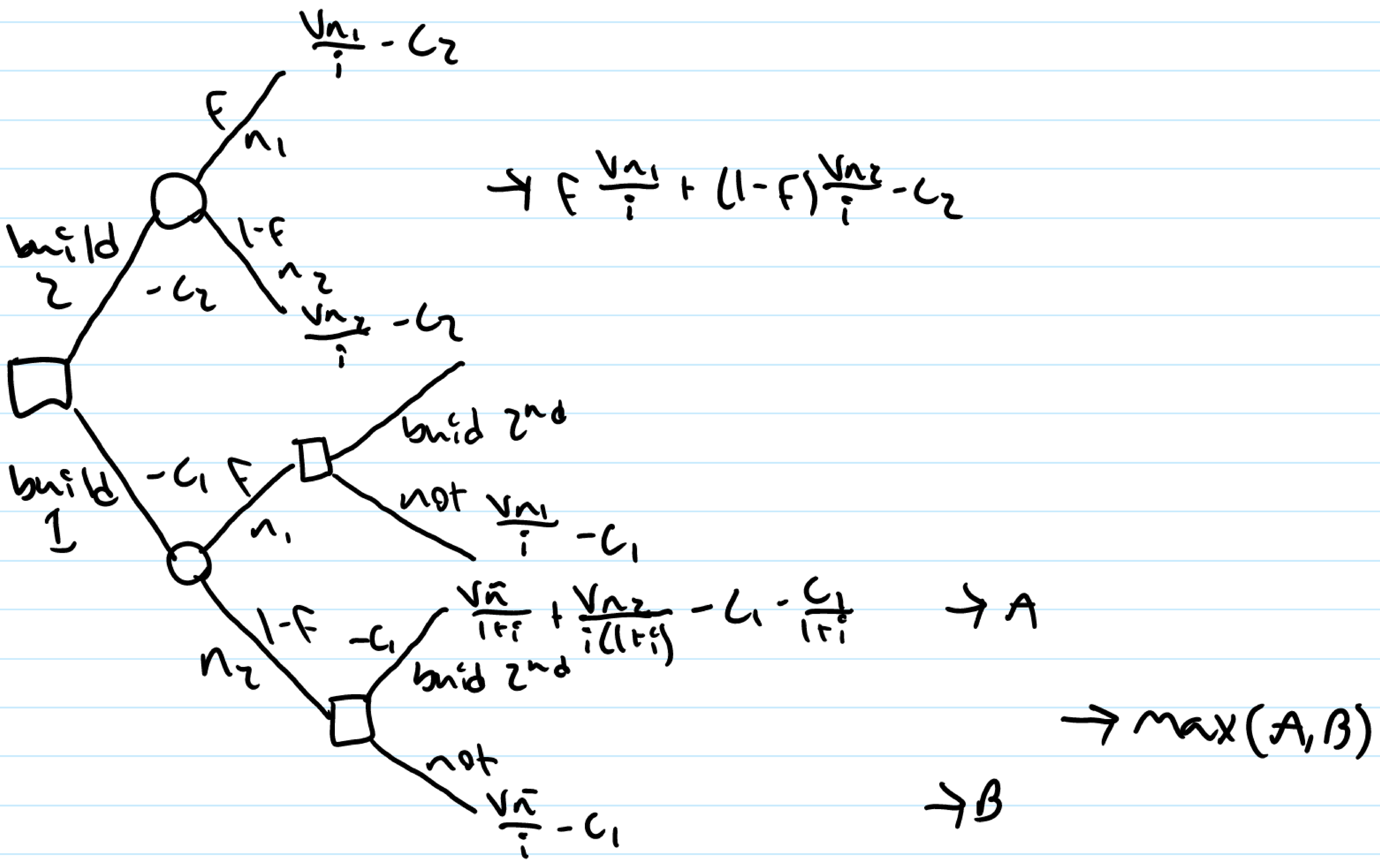
$ENPV_2 - ENPV_1 = \frac{(1-f)v}{i}(n_2 - \bar{n}) - (C_2 - C_1)$

high — serve more — always cost more

Build 2 or 1 now. MAYBE another later

Real option value or Quasi-option value

Put vs Call



Backwards Induction!

$\frac{v}{(1+i)} \cdot \left(\bar{n} + \frac{n_2 - n_1}{i}\right) - \frac{C_1}{1+i}$

Build 1 + wait → $ENPV = f\frac{vn_1}{i} - C_1 + (1-f)\max(A,B)$

build 2 @ start → $ENPV = f\frac{vn_1}{i} + (1-f)\frac{vn_2}{i} - C_2$

Assume $A > B$

Build 1 + wait → $ENPV = f\frac{vn_1}{i} + (1-f)\left[\frac{v\bar{n}}{1+i} + \frac{vn_2}{i(1+i)}\right] - C_1 - (1-f)C_1$

2: $ENPV = f\frac{vn_1}{i} + \left(\frac{1-f}{i}\right)vn_2 - C_2$

Sensitivity Analysis