E: Efficient incentive design, part 1

Principal-agent (PA) version of the biofuels startup

Participants:

Founder (F): Has **idea** but no cash
Venture capitalist (VC): Has **cash** but no idea

Payoffs:

Success (S): $1M
Failure (F): $10k
No startup (N): $100k

Principal-Agent changes:

1. Founder's effort (E) affects chance of success (S) but is costly to F

Level of effort	Cost to F	Prob of S
High (H):	**$5k**	**20%**
Low (L):	$2k	15%

2. VC only observes outcome (S or F), not E

Take F to be risk neutral in initial version
Focus purely on incentives

Initial question: What's the efficient level of effort?

Founder's overall EV of startup, in thousands:

H: 0.2*(1000 - 5)+0.8*(10 - 5) = 203
L: 0.15*(1000 - 2) + 0.85*(10 - 2) = 156.5

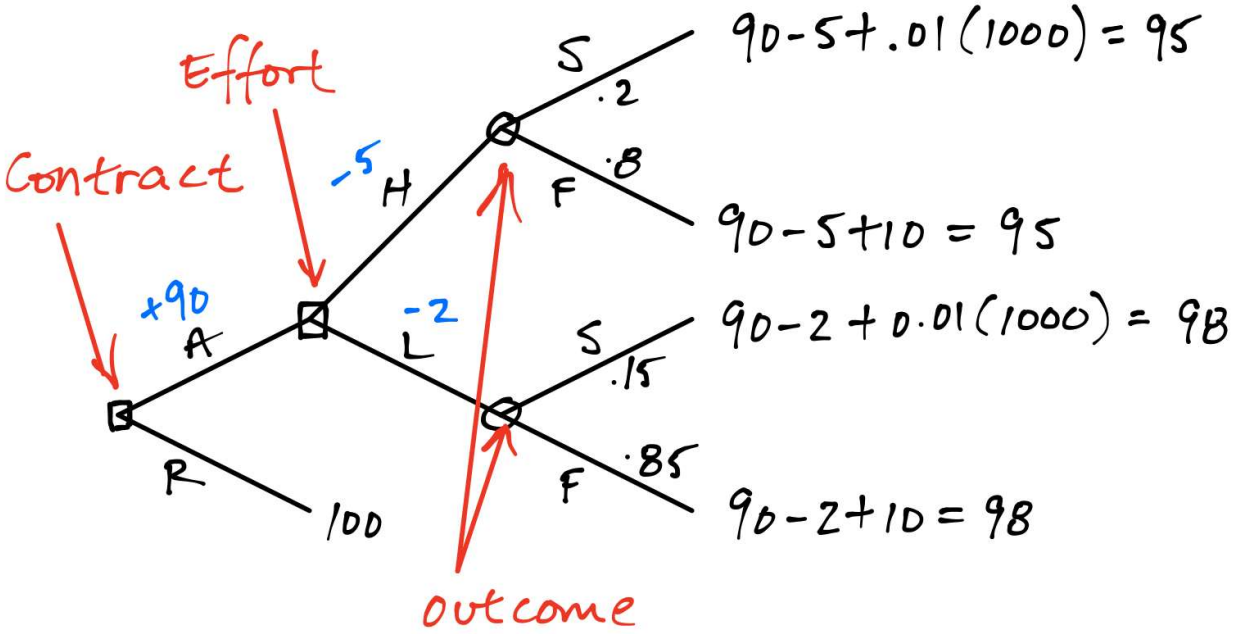
Conclusion: efficient effort is **H**

Case 1: VC offers previous $90k/99% contract

Two parameters:

Fixed payment (**Fx**):	$90k	VC pays to F
Share of ownership (**Sh**):	1%	Retained by F

Founder's tree with payoffs in thousands:



Contract decision: A = accept, R = reject

Effort decision: H = high, L = low

Outcome: S = success, F = failure

F's payoffs from **effort** choice:

$EV_H =$ 0.2*95 + 0.8*95 = 95

$EV_L =$ 0.15*98 + 0.85*98 = **98** Inefficient: would choose L

F's payoffs from **contract** choice:

A, then L: $EV_L = 98$

R: $EV_N =$ **100** Does not participate

Double fail:

1	F would pick L, not H	Not *incentive-compatible* (IC)
2	F wouldn't take contract	Fails *participation condition* (PC)