

### Problem 1 (20%)

A worker chooses effort  $e$ . By exerting effort, the worker produces a product in quantity  $q = ae$ , where  $e$  is effort and  $a$  is productivity. (Note that effort and abilities are multiplied.) The principal pays a wage  $W = bq + F$  where  $b$  and  $F$  are variable and fixed wage chosen by the principal. The principal earns profit  $\pi = pq - W$ , where  $p$  is the price on output. The worker's net wage is gross wage  $W$  minus cost of effort  $c(e) = \frac{1}{2}e^2$ . The worker's utility is  $u = W - c(e)$ . The worker will not take the job unless the utility is at least the reservation utility is  $u_0$ .

- For a given  $b$  and  $F$ , what effort will the worker provide?
- Show that, for a given  $b$  find a fixed wage,  $F = u_0 - \frac{1}{2}(ba)^2$  is the lowest fixed wage for which the worker will be (weakly) willing to take the job.
- Find the  $b$  and  $F$  the principal will choose to maximize profit. (Note that the principal will take into account the agent's optimal effort choice.)
- What is the first best choice of effort? (Maximizes the sum of agent net wage and principal's profit.) How does this relate to the effort the worker will provide when the principal set  $b, F$  to maximize profit and the worker maximize utility. (Note that even if you are unsure about the answer above, you can discuss to what extent the principals and agents behavior here will give first best.)

### Problem 2. (60%) (Note: There is no need to write a full essay.)

The enclosed paper is from the curriculum. Note: You can refer to tables and figures from the papers without copying them into your own text. **Enclosed paper:** Exley, Christine L, Muriel Niederle, and Lise Vesterlund. 2018. Knowing When to Ask: The Cost of Leaning-In, *Journal of Political Economy*.

- Explain briefly the basic experimental design for the lab experiment.
- In the abstract the authors conclude "Thus, our results caution against a greater push for women to negotiate." Explain how their results support this claim and discuss if the results warrant a caution against pushing women to negotiate, or if the caution should be gender neutral.
- Discuss briefly how the paper relates to the curriculum literature.

### Problem 3. (20%)

One paper in the curriculum studies self-selection into groups playing a public goods game (Hauge K. E., K. A. Brekke, K. Nyborg and J. T. Lind (2018). Sustaining cooperation through self-sorting: The good, the bad, and the conditional. PNAS. **The paper is not enclosed.**) The main claim of the paper is that in an initial choice, subjects self-sort into groups that are able to maintain cooperation in a public goods game. (2500 signs)

- Briefly describe which incentives players face in public good games. What is the Nash equilibrium contribution and what range of contribution levels is typically observed in the lab?

- b) Focus on one, e.g. study 1, in the paper. The subjects made one choice determining which kind of group they are in and then played a public goods game. Describe the choice used to sort them into group and the impact this sorting had on the subsequent public goods game. Discuss why you think it had this impact.