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 workers 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.

a) For a given b and F, what effort will the worker provide?

The workers maximize $b(ae) + F - \frac{1}{2}e^2$. This yields first order condition: $ba = e$

b) 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.

We know that $e = ba$, and hence utility is $b(ae) + F - \frac{1}{2}e^2 = F + \frac{1}{2}(ba)^2 \geq u_0$, so $F = u_0 - \frac{1}{2}(ba)^2$

c) Find the b *and* F the principal will choose to maximize profit. (Note that the principal will take into account the agents optimal effort choice.)

Profit is $pq - W = pae - bae - F = pa^2b - (ab)^2 - u_0 + \frac{1}{2}(ba)^2 = pa^2b - \frac{1}{2}a^2b^2 - u_0$ with first order condition $pa^2 = a^2b$, so $b = p$. Inserting into b) we get $F = u_0 - \frac{1}{2}(ba)^2 = u_0 - \frac{1}{2}(pa)^2$

d) 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.)

It should be well known from the class that this gives first best, as there is no multitasking nor uncertainty. As the wage is pure transfer, if we maximize joint payoff we maximize $pq - c(e) = pae - c(e)$ which is what the worker would do if he owned the firm. We note that is what the worker actually do in a) -c) as $b = p$. Hence it is $e = pa$ which is the solution above.

Problem 2. (60%; a:20% + b:40%) (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 you 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*.

a) Explain briefly the basic experimental designed for the lab experiment.

In the seminars students have trained to present papers, and they know that the exam will be similar, thus they should be able to present the design such that a well-willing reader can grasp the basics.

The basic design is a follows: Subjects are randomly assigned as workers or employers. They both do the same task, workers earn 10, 15 or 20, while employers earn 20 or 25. A worker and an employer are randomly matched to share the joint earning with a wage for the worker and the rest to the

employer. A computer suggests a wage for the worker, the suggested wage is the workers earning plus a bonus that is -2, -1, 0 or +2. The worker can accept the wage or open negotiation. Negotiation is open form chat with a time-limit. If they agree that distribution is implemented, otherwise, they get their earning minus a penalty of 5 each. In an alternative treatment, workers are forced to negotiate always.

b) 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.

The results show that workers who choose to negotiate increase their earnings, women choose to negotiate less often and earn less. In the treatment where workers are forced to negotiate both men and women earn less than in the base treatment.

The basis for this claim is that even though women earn less in the base treatment and even though this can be explained with a lower willingness to open negotiation, they earn even less if they are forced to negotiate. The paper present this as a result on gender inequality, but the results show that also men lose from being forced to negotiate, thus it can be seen as a case against paternalism rather than just about gender inequality.

c) Discuss briefly how the paper relate to the curriculum literature.

There are several papers on gender differences in the curriculum finding that women are more risk averse, more likely to avoid competition, are less over-confident and as we see here also less likely to open negotiations. While some, like the Niederle and Vesterlunds paper on competitiveness, find that it is just as much men who behave suboptimal in the other directions, it is typically interpreted as a call for women to change their behavior and become more like men. (Maybe natural as men don't want to change to earn like a woman.) The paper is a response to this.

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 games.

a) 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?

The students should know public goods game, and it is easiest to explain using an example rather than equations, no formal discussion is needed.

Using the public goods game from the paper as an example: the players decide how much of an endowment of 80 to give to a public good versus to keep. The amount contributed to the public good is doubled and shared with the group of three. Thus, if the player gives 10 kroner, this is doubled and the three divide the 20 kroner, giving each 6,66 kroner (MCPR of 2/3). The player thus get less back than he put in and has incentives to keep all the endowment.

What we typically see is that when the game is played players give a substantial share of their endowment, often up 50-70% depending on the parameters of the game. But this share drops over time as the game is repeated.

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.

The players had to choose between giving 60 kroner to the red cross (red groups) or keeping the money to themselves (blue). They were sorted to play the public goods game with others that made the same choice. In the subsequent public goods game the red group had initially slightly larger contributions but most significantly they remained constant while contributions in the blue groups showed the typical decline. A possible explanation is that most players are conditional cooperators. Since red groups attract higher shares of altruists (and conditional cooperators), resulting in fairly high initial contributions, contribution levels will not decline too much, since conditional cooperators keep reciprocating. However, blue groups tend to attract free riders. Even with some conditional cooperators sorting into the blue groups, their potential for contribution is not realized since they respond to free-riders by lowering their own contribution levels, resulting in declining contribution levels.

(2500 signs)