1. Consider the long-run employment decision of a perfectly competitive firm, and suppose that this firm faces a monthly salary of $2,550 per worker and monthly capital costs of $1,700 per unit. Suppose the cost-minimizing level of employment is $E^* = 120$ workers, and that this cost-minimizing level is attained at a cost outlay of $C_0 = $663,000 per month.

(a) What is the optimal level of units of capital $K^*$ associated with $E^*$?
(b) Which condition has to hold at the cost-minimizing allocation of capital and labor? Give an interpretation of this condition.
(c) Sketch the solution in a capital/labor diagram. Then suppose that the monthly salary decreases to $2,040 per worker. What can we say about the new cost-minimizing point of $K$ and $E$? Specifically, what happens to the isocost line? Will the firm increase or decrease its initial cost outlay $C_0$? Why?

2. Consider a perfectly competitive firm with a production function $q = f(x_1, x_2, x_3)$, where $x_1$ denotes units of capital, $x_2$ denotes unskilled workers, and $x_3$ denotes skilled workers. The firm maximizes profits using an input mix of $x_1 = 200$, $x_2 = 70$, and $x_3 = 50$. The initial price of capital is $80 per unit. Suppose the firm faces a change in the price of capital to $96 per unit. As a consequence, it increases its employment of unskilled workers to 77, while at the same time laying off 5 skilled workers.

(a) What is the cross-elasticity of demand for unskilled workers with respect to capital?
(b) What is the cross-elasticity of demand for skilled workers with respect to capital?
(c) Are the two inputs "unskilled labor" and "capital" substitutes or complements? Why?
(d) Are the two inputs "skilled labor" and "capital" substitutes or complements? Why?
(e) Are the results from (a) through (d) consistent with the so-called "capital-skill complementarity hypothesis"? Why (not)?

3. In a particular industry, labor supply is $ES = 10 + w$ while labor demand is $ED = 40 - 4w$, where $E$ is the level of employment and $w$ is the hourly wage.

(a) What is the equilibrium wage and employment if the labor market is competitive? What is the unemployment rate?
(b) Suppose the government sets a minimum hourly wage of $8. How many workers would lose their jobs? How many additional workers would want a job at the minimum wage? What is the unemployment rate?
(c) What can you say about the efficiency of the employment outcome once the minimum wage is imposed? Compare producer and worker surplus with the competitive equilibrium. Is there a deadweight loss?

4. Suppose the supply curve in a particular industry is given by \( w = 10 + 1.2E \) and the demand curve in that industry is given by \( w = 50 - 0.8E \), where \( E \) = employment and \( w \) = hourly wage.

(a) Calculate the equilibrium wage and employment level in that industry. Illustrate your solution in a graph.
(b) Now suppose the government imposes a payroll tax of $8 on the firm for every employee-hour it hires. What happens to the initial equilibrium in that industry? In your explanation, also calculate the new equilibrium wage and employment level, and illustrate your solution in a graph [you can include the solution in the graph you already drew in part (a)].
(c) In the new equilibrium, what is the total cost of hiring an employee-hour of work? Therefore, what share of the $8 tax will the firm pay, and how much will be shifted to the worker? In what respect does the fraction of the payroll tax that workers pay depend on the elasticity of the supply curve?
(d) Does it matter whether the $8 payroll tax is imposed on the firm or on the worker? Why (not)?