ECO3041: Industrial Organisation
Mock mid-term short answer test 2014

You have one hundred minutes to answer the twenty questions below. (So five minutes per question.) Each question will be marked out of 10. If you get the right answer you will score a minimum of 6 points on a question. If it is absolutely clear to me that you got to the right answer in the right way, then you will get a minimum of 8 points. To get the maximum of 10/10 on a question, your presentation must be perfect: this means saying what you are doing at each step, and why you are doing it.

1) Prove that the demand curve $Q(p) = \frac{10}{\sqrt{p}}$ is iso-elastic.
2) Prove that the demand curve $Q(p) = \frac{1}{2+3p}$ is not iso-elastic.
3) Derive the demand curve corresponding to the inverse demand curve $p(Q) = \frac{3}{Q^3}$.
4) A monopolist faces an inverse demand curve $p(Q) = 4 - Q^2$ and has total costs to produce a quantity of Q given by $C(Q) = Q$. Find its optimal choice of Q.
5) In the set-up of the previous question, what profits does the firm make at the optimal choice of Q?
6) A monopolist faces the inverse demand curve $p(Q) = \frac{1}{\sqrt{Q}}$ and has constant marginal costs. Prove that it will set a price equal to double its marginal cost.
7) A monopolist faces the inverse demand curve $p(Q) = 27Q^{-\frac{2}{3}}$ and has constant marginal cost c. What is its optimal quantity, as a function of marginal costs?
8) A monopolist faces the inverse demand curve $p(Q) = \frac{1}{Q^2}$ and has zero marginal costs. Prove that the optimum price is infinite.
9) A monopolist faces the inverse demand curve $p(Q) = \frac{1}{2Q}$ and has zero marginal costs (and no fixed costs). Prove that it is indifferent about what price to set.
10) Suppose an industry with n firms faces the inverse demand curve $p(Q) = 1 - Q$. Suppose further than the firms are competing in quantities, and that each firm has zero marginal cost. Prove that as the number of firms, n, goes to infinity, the industry price goes to zero.
11) Suppose that the bagged ice cube industry in England contains n firms competing under Cournot competition, and suppose that the demand for bags of ice cubes has always been given by $Q(p)$. Before the year 2100, all producers of bags of ice cubes had marginal costs of 1. However, in the year 2100, global warming passed a tipping point, which thanks to movements in the gulf-stream, led to the north of England getting much colder, and the south of England getting much hotter. As a result, the marginal costs for all of the northern firms fell to zero, and the marginal costs of all the southern firms doubled to 2. Assuming that there are as many producers of bags of ice cubes in the north as in the south, prove that the total quantity of ice cubes produced will not change.
12) Suppose an industry with n firms faces the inverse demand curve $p(Q) = \frac{1}{Q}$ and suppose that each firm in the industry has constant marginal cost equal to 1. Prove that under Cournot competition, the total quantity produced by the industry will be equal to $\frac{n-1}{n}$.
13) In the set-up of the previous question, how many firms would enter the industry if entry required the payment of an cost of $\frac{1}{10}$?

14) Two firms compete in Cournot competition. One firm has constant marginal cost equal to 1 and the other firm has constant marginal costs equal to 2. They face the inverse demand curve $p(Q) = \frac{1}{Q}$. What quantity will be produced by the firm with the lower marginal costs?
15) Four firms compete in Cournot competition. One firm has total costs given by $C_1(q_1) = 4 + q_1$; the next has total costs $C_2(q_2) = 3 + 2q_2$; the next has total costs $C_3(q_3) = 2 + 3q_3$; and the last has total costs $C_4(q_4) = 1 + 4q_4$. They face the inverse demand curve $p(Q) = 40 - 2Q$. What is the total quantity produced?
16) Three firms all have constant marginal costs of $£200$, and compete in Bertrand competition, subject to the constraint that prices must be whole numbers of pounds. Describe the pure strategy Nash equilibria of this game in which total industry profits are highest, proving that it is indeed a Nash equilibrium, and that there cannot be an equilibrium with higher profits.
17) Three firms compete in Bertrand competition, subject to the constraint that prices must be whole numbers of pounds. The first firm has constant marginal cost equal to $£100$, the second firm has constant marginal cost equal to $£200$ and the third firm has constant marginal cost equal to $£300$. Prove that there is at least one Nash equilibria of this game in which the good is sold at a price of $£200$, providing demand is nowhere upwards sloping.
18) GlaxoSmithKline (GSK) holds the patent to a new drug, but decides to license it out to other firms rather than producing the drug itself. It charges firms a fixed fee $F > 0$ in order to license the patent. Once a firm has licensed the patent, it can produce the drug at a marginal cost of c. Assuming those firms that do license the drug compete in prices in pure strategies and assuming that monopoly profits from selling the drug would be $\pi_M \geq F$, how many firms will choose to license the patent?
19) An industry contains two firms competing under Cournot competition, with zero marginal costs, and facing the inverse demand curve $p(Q) = 1 - Q$. What will be the value of total welfare?
20) An industry contains a monopolist with marginal costs of $\frac{1}{6}$ (and no fixed costs). The firm faces the inverse demand curve $p(Q) = 1 - Q$. What will be the deadweight loss due to monopoly?