

HECON4220 — Paying Providers of Health Care

Written examination, 27 March 2026

Solution and evaluation guidance for the external assessor

This document accompanies the examination paper and is intended for an external assessor. It sets out (i) the intended solutions to all three parts of the exam, (ii) the weights applied when grading, and (iii) indicative marking criteria and typical errors to look for. The exam consists of three parts of equal weight. Part 1 (eight short analytical questions) and Part 3 (ten multiple-choice questions) are assessed against the specific answers given below. Part 2 (one open-text question with three sub-tasks) is assessed against the evaluation rubric in Section 4.

Scoring scheme. Each sub-task carries an integer number of points. The point allocation is chosen so that the three parts carry exactly equal weight:

- Part 1 — 8 tasks $\times$ 15 points = 120 points.
- Part 2 — 3 tasks $\times$ 40 points = 120 points.
- Part 3 — 10 tasks $\times$ 12 points = 120 points.
- Total = 360 points; each part = 1/3 of the grade.

The thresholds are as follows:

Grade	points
A	325-360
B	295-324
C	235-294
D	217-252
E	100-216
F	0-99

2. Recap of the Part-1 study setting

To ease reading, the study setting used in Part 1 is summarised below. Throughout Part 1, each provider treats only one patient type, and the patient is passive. The regulator maximises social welfare.

Equation A (cost): $C(q) = 4q$, so
marginal cost $k = 4$.

Equation B (health): $H(q) = 20 \cdot \ln(q)$,
so $h = 20$.

Equation C (marginal H): $\partial H / \partial q = 20/q$.

Equation D (profit): $\pi(q) = PS - C(q)$,
where PS is the payment system.

Equation E (utility): $V(q) =$
 $[1-\alpha] \cdot \pi(q) + \alpha \cdot H(q)$, with $0 \leq \alpha \leq 1$.

Professional norm: every participating provider chooses q^* in the interval $[1, 15]$. Participation requires $\pi(q^*) \geq 0$.

3. Part 1 — solutions (120 points, 15 per task)

Part 1 contains eight sub-questions, each worth 15 points. Award the full 15 points only when the answer is fully correct and properly justified. For each task the marking note identifies the components of a good answer; score 15 / 10 / 5 / 0 according to how many components are present. Small sign errors or rounding should be treated leniently (10 rather than 5) provided the economic reasoning is correct.

Q1.1 Interpretation of α , with $\alpha = 0$ and $\alpha = 1$. (15 points)

Expected answer. The parameter α measures the strength of the provider's patient-regarding preferences (the weight on patient health relative to own profit in the utility function V). It captures the degree of altruism or the extent to which the provider acts as an agent for the patient. When $\alpha = 0$, the provider places no weight on patient health and behaves as a pure profit maximiser: $V(q) = \pi(q)$. When $\alpha = 1$, the provider places no weight on profit and behaves as a pure patient-health maximiser: $V(q) = H(q)$. Intermediate values $0 < \alpha < 1$ represent mixed motives.

Marking note. Full credit requires (i) identifying α as the weight on patient health / degree of patient-regarding preferences, and (ii) correctly stating the two limiting cases. Reference to 'altruism', 'agency', 'professional ethics' or 'intrinsic motivation' as alternative interpretations is acceptable and consistent with the course book chapter.

Q1.2 $V(q)$ for a profit-maximising provider. (15 points)

With $\alpha = 0$ the utility function collapses to profit:

$$V(q) = \pi(q).$$

Under the general mixed payment the explicit form is $V(q) = A + (F - 4)q$.

Q1.3 $V(q)$ for a pure patient-health-maximising provider. (15 points)

With $\alpha = 1$ the utility function becomes the patient health benefit:

$$V(q) = H(q) = 20 \cdot \ln(q).$$

Q1.4 Profit $\pi(q)$ under a mixed payment system $I = A + F \cdot q$. (15 points)

$$\pi(q) = A + F \cdot q - 4q = A + (F - 4) \cdot q.$$

A shifts the profit line vertically; $(F - 4)$ is the slope. Whether profit is increasing, constant, or decreasing in q is determined by the sign of $(F - 4)$.

Q1.5 $A = 60, F = 2, \alpha = 0$. Choice of q and participation check. (15 points)

With $\alpha = 0$ the provider maximises $V(q) = \pi(q) = 60 + (2 - 4)q = 60 - 2q$. Since the slope is negative ($F = 2 < k = 4$), profit is strictly decreasing in q . Within the professional norm $1 \leq q \leq 15$ the utility-maximising choice is therefore the lower bound:

$$q^*_{MD} = 1.$$

Participation check: $\pi(1) = 60 - 2 \cdot 1 = 58 \geq 0$, so the participation constraint is satisfied with a substantial margin.

Marking note. Students should refer explicitly to the sign of $(F - k)$ and to the professional-norm bound to justify the corner solution. A student who correctly identifies 'provider wants as few services as possible' but omits the norm bound should receive partial credit; the bound is what pins down a well-defined numerical answer.

Q1.6 $A = 60, F = 7, \alpha = 0$. Choice of q and participation check. (15 points)

With $\alpha = 0$ the provider maximises $V(q) = \pi(q) = 60 + (7 - 4)q = 60 + 3q$. The slope is positive ($F = 7 > k = 4$), so profit is strictly increasing in q . Within the norm $1 \leq q \leq 15$ the utility-maximising choice is the upper bound:

$$q^*_{MD} = 15.$$

Participation check: $\pi(15) = 60 + 3 \cdot 15 = 60 + 45 = 105 \geq 0$, well above zero.

Marking note. As in Q1.5, credit should depend on a clear argument about the sign of $(F - k)$ and the binding norm bound. Students who simply write ' $q = 15$ ' without this reasoning have not demonstrated the economic intuition.

Q1.7 $q^*_{Society}$. (15 points)

The socially optimal intensity equates marginal benefit to marginal cost:

$$\frac{\partial H}{\partial q} = \frac{\partial C}{\partial q} \Rightarrow 20/q = 4 \Rightarrow q^*_{Society} = 20/4 = 5.$$

Full credit for $q^*_{Society} = 5$ with a brief derivation. Stating ' $q^* = 5$ ' without the marginal-benefit-equals-marginal-cost argument merits partial credit only.

Q1.8 Why is there a substantial difference between $F > 4$ and $F < 4$? (15 points)

This question asks for an economic interpretation rather than a new computation. The key point is that $F = 4 = k$ is the knife-edge case where marginal revenue equals marginal cost. A good answer mentions the following points:

- Marginal revenue from an extra unit of q is F ; marginal cost is $k = 4$.
- If $F > 4$, marginal revenue exceeds marginal cost: every extra unit of q adds to profit, so a profit-oriented provider (α close to 0) chooses q at the upper norm bound $q = 15$. This yields oversupply relative to $q^*_{Society} = 5$.
- If $F < 4$, marginal revenue is below marginal cost: every extra unit reduces profit, so a profit-oriented provider chooses the lower norm bound $q = 1$. This yields undersupply relative to $q^*_{Society} = 5$.
- Only at $F = 4$ (the knife-edge) is the profit-oriented provider indifferent over q , so $q^*_{Society} = 5$ can in principle be implemented — this then also requires a fixed-payment component A large enough to satisfy participation, leading to the mixed-payment result familiar from Lectures 3–4 and Seminar 1.

Marking note. A complete answer should identify $F = k = 4$ as the critical threshold and relate the two regimes to over- and under-supply. Credit should be given where the reasoning appeals to marginal revenue vs. marginal cost, even if the student does not use the word 'knife-edge'. Reference to the participation constraint becoming binding in the $F < 4$ case (where a positive A is needed to keep $\pi \geq 0$) is a sign of deeper understanding.

4. Part 2 — open-text question (120 points, 40 per sub-task)

The Part-2 question asks for a short structured text (approximately 300–400 words) built around three sub-tasks. Each sub-task is worth 40 points and should be marked separately, even though the student presents a single running text. If an answer addresses the three sub-tasks in a different order or weaves them together, assign points to whichever paragraph or passage covers each sub-task.

Q2.1 Scale and the degree of relevant risk aversion. (40 points)

Model answer. A provider's relevant degree of risk aversion depends not only on individual preferences but on the scale of the organisation. A solo physician's income depends on realised costs for a small number of patients; a single expensive patient is a material shock. In large hospitals, many independent cost shocks are pooled across patients and physicians, so the variance of the average per-physician payoff is small. Formally, with a concave utility function such as $U(\pi) = \ln(\pi)$, the risk premium for a given absolute cost spread falls rapidly as the scale s grows: in the course example with a ± 3 spread, the per-physician premium is about 0.46 at $s = 1$, 0.0045 at $s = 10$, and effectively zero at $s = 100$ (Lecture 6, Seminar 2). Large providers therefore behave approximately as risk-neutral, whereas small providers must be treated as genuinely risk-averse.

Required elements (for full 40 points):

- Recognition that effective risk aversion depends on scale, not only on preferences.
- Mechanism stated: risk pooling / diversification across patients or physicians.
- Direction of the result: premium per physician decreases

with scale; large $\rightarrow$ approximately risk-neutral, small $\rightarrow$ genuinely risk-averse.

- Credit (but not required) for reference to the course's $\ln(\pi)$ example or to the Arrow–Pratt intuition that $A(\pi) = 1/\pi$ falls with scale.

Common weaker answers. Confusing 'risk aversion' with 'risk' or 'uncertainty' (conflating provider preferences with the environment); treating all providers as equally risk-averse; failing to connect the concept to organisational size.

Q2.2 Balancing prospective payment and partial cost reimbursement γ . (40 points)

Model answer. The regulator's problem places two forces in tension. A prospective payment ($\gamma = 0$) puts full cost responsibility on the provider and delivers strong cost-control incentives: in the course's Case 4 specification, effort e is maximised at $e = 1$ when $\gamma = 0$ and falls linearly to zero as γ rises to 1. Partial cost reimbursement ($\gamma > 0$) shifts risk onto the payer, lowering the risk premium needed to secure participation. The optimal γ therefore balances cost-control incentives against efficient risk sharing. If the provider is risk-neutral (Cases 1–2), or if effort is contractible regardless of risk attitude (Cases 1 and 3), full cost responsibility $\gamma = 0$ (or equivalently full reimbursement with an effort clause in Case 3) is optimal. Only in Case 4 — risk-averse provider, non-contractible effort — is interior γ^* optimal: $\gamma^* = r \cdot \sigma^2 / (1 + r \cdot \sigma^2)$, which is increasing in risk aversion r and in cost variance σ^2 . Because small providers have higher effective r , the optimal γ^* is larger for small than for large providers.

Required elements (for full 40 points):

- Explicit statement of the trade-off: cost-control incentives vs. efficient risk sharing.
- Direction of γ in the four Cases of ZBK Ch. 10: $\gamma = 0$ optimal for risk-neutral or contractible-effort cases; interior $\gamma^* \in (0, 1)$ in Case 4.
- Correct comparative statics: γ^* increases with r and with σ^2 .
- Application of this result to the small-vs-large distinction: small providers $\rightarrow$ higher γ^* ; large providers $\rightarrow$ lower γ^* .

Common weaker answers. Confusing γ with α ; stating that $\gamma = 0$ is always optimal; reversing the comparative statics; or treating the trade-off as uni-dimensional (only incentives or only risk sharing).

Q2.3 Application to the primary-care setting (capitation / FFS / mixed). (40 points)

Model answer. In the Part-1 primary-care setting, solo GPs and small group practices are the closest analogue to a small, risk-averse provider; large list-based practices or integrated primary-care organisations resemble the large, near-risk-neutral case. Pure fee-for-service removes cost risk (the payer absorbs it via the fee structure) but cannot secure q^* Society with linear costs (see Part 1, Q1.8 and Examples 3–4 of the course book). Pure capitation places all cost risk on

the provider — workable for large practices, but burdensome for small ones. A mixed system (base capitation or fixed payment A combined with a fee component F , or a base budget with partial cost reimbursement $\gamma > 0$) is the general answer: it can reach q^* Society regardless of α (Examples 5 and 7 of the course book) and, simultaneously, protect small practices from undue cost risk. The smaller and more risk-averse the practice, the larger the optimal cost-reimbursement share.

Required elements (for full 40 points):

- Identification of pure FFS, pure capitation, and mixed payment as the three alternatives from the course framework.
- Recognition that pure FFS cannot implement q^* Society with linear costs (link back to Part 1, Q1.8 or Examples 3–4).
- Recognition that pure capitation imposes full cost risk on the provider — a concern for small practices.
- Clear conclusion that a mixed / blended system is preferred in the small-practice case, with a larger cost-reimbursement share for smaller practices.

Common weaker answers. Treating the three payment systems as equally suitable without connecting them to the scale / risk argument from Q2.1–Q2.2; omitting the FFS-cannot-reach- q^* Society point; failing to state any preference between the three systems.

Length guidance. The question indicates 300–400 words across the three sub-tasks combined. Answers that stay within $\pm 25\%$ of this range should not be penalised on length alone. Very short answers (< 150 words total) that omit required elements should be marked down on content grounds within each sub-task.

5. Part 3 — multiple-choice answer key (120 points, 12 per question)

Ten questions, each with a single correct answer and three distractors. Each question is worth 12 points: 12 for the correct option, 0 otherwise. Inspira records responses and awards points automatically. The key is reproduced below for verification and, where useful, with a short note on the source and on the intended trap in the distractors.

Q3: correct answer = B. (12 points)

Course notation $I = A + F \cdot q$: A is the fixed (activity-independent) payment, F is the fee-for-service rate per unit of q . (Lectures 3–4; Equations A–E.) Distractor (A) reverses the two roles — a common beginner error. (C) confuses A with the capitation rate R ; (D) is unrelated.

Q4: correct answer = B. (12 points)

In $V(q) = [1 - \alpha] \cdot \pi(q) + \alpha \cdot H(q)$, α weights patient health in the provider's utility. (Eq. E.) (A) describes F ; (C) relates to the contractibility of effort in ZBK Ch. 10; (D) describes γ .

Q5: correct answer = C. (12 points)

$\alpha = 0 \Rightarrow V(q) = \pi(q)$ — pure profit maximiser. (A) corresponds to $\alpha = 1$; (B) to $\alpha = 0.5$; (D) is unrelated to α and belongs to Lecture 6.

Q6: correct answer = C. (12 points)

With $\pi(q) = (F - k) \cdot q$ under pure fee-for-service and linear costs, $\pi(q) \geq 0$ for $q > 0$ requires $F \geq k$. (A) violates participation; (B) and (D) are not participation conditions.

Q7: correct answer = B. (12 points)

Pure fee-for-service with linear costs cannot implement q^* _Society for any α : at $F = k$ profit is zero regardless of q and no unique interior optimum exists; at $F \neq k$ the participation constraint binds away from q^* _Society. (Examples 3 and 4 of the course book; Seminar 1.) (A) is wrong because the direction of mis-supply depends on the sign of $F - k$.

Q8: correct answer = C. (12 points)

The central course result: a mixed payment with appropriately chosen A and F can implement q^* _Society for any $\alpha \in [0, 1]$. (Examples 5 and 6.) (A) and (B) are too strong; (D) contradicts the course result.

Q9: correct answer = B. (12 points)

In ZBK Chapter 10 the payer's welfare is $W = B - P$ and the payer is treated as risk-neutral; this is explicit in Box 10.1.

Q10: correct answer = B. (12 points)

The demand elasticity with respect to waiting time is small in absolute value; Siciliani & Iversen (2012) report an overall estimate of approximately -0.09 (Martin & Smith 2003 panel estimate), i.e. inelastic demand. (A) and (C) overstate responsiveness; (D) understates it (demand is inelastic, not unresponsive).

Q11: correct answer = B. (12 points)

Case 4 (risk-averse provider, non-contractible effort) is defined precisely by the trade-off between cost-control incentives (pushing γ down) and efficient risk sharing (pushing γ up). ZBK §10.2.2.2. (A) belongs to §10.3 (casemix, selection).

Q12: correct answer = B. (12 points)

Full cost responsibility ($\gamma^* = 0$) is optimal if providers are risk-neutral (Cases 1–2) or if effort is contractible regardless of risk attitude (Cases 1 and 3). (Lecture 7 summary; ZBK §10.4.) (A) is the opposite case — where $\gamma > 0$ is needed.