Health Economics, Exam June 2010
Hints for solution

Problem 1.

The textbook background is the either the lecture note 13 or alternatively chapter 12 in ZBK, which deal with the market for pharmaceutical drugs.

1.1. We need a short description of the problems facing the firm, namely that patent has to be taken out before the competitors (patent races), combined with the need for carrying out Phase I-III tests of the drug before market permit can be obtained. These two issues have as a consequence that effective patent duration is much shorter than the 20 years, in practice between 5 and 8 years.

1.2. The patent owner may possibly use research advantages to create a new and related product for which a new patent can be taken out. Otherwise the market share will be determined as in other markets, but the patent owner may have used the duration of the patent to create patient and provider preferences for the specific brand.

1.3. A pharmaceutical company oriented towards profit must take into consideration that the specific drug, if created, will be subject to severe price controls, and in view of this it may choose not to develop the drug. Some comments on alternatives to the patent system (such as public research contracts or prizes) may be added at this point, since such arrangements are robust against forecasts of low future profits.

Problem 2.

2.1. The QALY idea is to assign numbers $V(Q)$ to health states Q, such that $V(Q^*) = 1$ and $V(Q_*) = 0$ where Q^* is "perfect health"and Q_* is the health state "dead"or a health state preference equivalent to that. In the simple linear QALY model, $V(\cdot)$ is determined such that the measure

$$QALY = T * V(Q),$$

gives number of years in perfect health which is just as good as T years in health state Q.

The quality-adjustment factor $V(Q)$ can be determined by RS (Rating Scale) techniques, TTO (Time Trade-Off) techniques, SG (Standard Gamble) techniques, and PTO (Person Trade-Off) techniques). See for example the book (ZBK section 2.3.3) for definitions and discussion.

2.2. For the case (i), suppose that $\succsim_i$ is an individual preference relation on health profiles (Q,T). Then a $QALY$ model of the form $T*V(Q)$ represents $\succsim_i$ if and only if the following four axioms hold: The Zero Condition (ZERO), Continuity in life time (CONT), Positivity (POS) and Lifetime Scale Independence (LSI). See Østerdal (2005) for the mathematical definitions and interpretation.

For the case (ii), suppose individual preferences are in accordance with the expected utility model, and that a function of the form governs $U(T,Q)$ governs preferences for lotteries over health profiles.Then, $U(T,Q)$ has the linear QALY form $U(T,Q) = T*V(Q)$ if and only if the following two preference conditions hold: $U(Q,0) = U(Q',0)$ for all health states Q,Q' (that is, preferences satisfy the zero condition (ZERO) in an expected utility formulation) and risk neutrality in life years for any fixed health state Q.

The zero-conditions under (i) and (ii) respectively have a similar meaning. The LSI axiom is similar in spirit to risk neutrality in life years but is weaker in the sense that for example a function of the type $U(T,Q) = \sqrt{T}*V(Q)$ is consistent with LSI in case (i) but not with risk neutrality in case (ii). CONT is a technical condition, in the sense that it cannot be rejected from any finite number binary preference observations. The POS condition/axiom is not needed for the case (ii) model, as health states worse than death is allowed.

Problem 3.

3.1. The human-capital approach and the Willingness to Pay (WTP) approach to valuing life-saving programmes (or health care programmes more generally) are described in the book in section 2.4.2 and section 2.4.3 respectively, see ZBK pages 43-45. Briefly, according to the human-capital approach, the value of life is defined as the discounted sum of the individual's future contributions to the social product (which corresponds to future labor income assuming that the wage is equal to the value of marginal product). In contrast to the human-capital approach, the WTP approach is based on the concept of individual utility. Indeed, according the WTP approach, the value of life is determined from the marginal willingness to pay for an in-

crease in the probability of surviving (a given period) and amount the value of a "statistical life".

A situation where the human-capital approach seems particularly appropriate is the (unrealistic) scenario where society's welfare is appropriately measured by the GNP (i.e. by a measure that ignores the pleasure of living as such), or a situation where individual preferences and the intrinsic value of life is particularly hard to assess for either practical or ethical reasons.

Examples of situations where the WTP approach seems particularly appropriate may include: cases where the subjective value of living/surviving ought to be taken into account, where the life-saving programmes involve only small changes in individual risk (for a great number of people), and where differences in individual initial risks and income profiles are roughly equally distributed between competing health care programmes.

3.2. The marginal WTP for an increase in the probability of survival is:

$$MRS(\sigma_i, y_i) = \frac{\frac{\partial U_i}{\partial \sigma_i}}{\frac{\partial U_i}{\partial y_i}} = \frac{u(L, y_i) - u(D, y_i)}{\sigma_i u'_{y_i}(L, y_i) + (1 - \sigma_i) u'_{y_i}(D, y_i)}.$$

The MRS is closely related to the Value of a Statistical Life (VSL). To see this, note that individual willingness-to-pay for the intervention is approximately $MRS(\sigma_i, y_i) * \Delta\sigma_i$, where $\Delta\sigma_i$ is the change in probability of surviving for individual i. Assuming (for simplicity) that the probability changes are the same for everyone on the population,we have:

$$\text{total WTP} = \text{mean MRS} * \text{total expected number of lives saved},$$

or

$$\text{mean MRS} = \frac{\text{total WTP}}{\text{total expected number of lives saved}}.$$

Hence the average MRS for a population is approximately equal to the VSL for that population.