# Final Exam

## 1.a.

The discount factor is the weight at which future income is devalued when calculating its present value.

In this case, a discount factor of 0.95 means that the value of 1 dollar of income 1 period into the future is 95 cents.

## 1.b.

$$r = \frac{1}{d} - 1 = \frac{1}{19} \approx 0.05263157895...$$

## 1.c.

$$NPV_X = \sum_{x \in X} \frac{x_{\text{value}}}{(1-r)^{x_{\text{period}}}}$$

$$NPV_{\text{op}} = \$15.2635$$

$$NPV_{\text{ac}} = \$12.2635$$

I'd rather be an ophthalmologist.

## 1.d.

$$IRR_X = \sqrt[\text{length}(X)]{\frac{\sum_{x \in X} x_{\text{value}}}{NPV_X}} - 1$$

$$IRR_{\text{op}} = 2\sqrt[4]{\frac{2250}{30527}} - 1 \approx 0.04208847665...$$

This value is less than the interest rate.

## 1.e.

$$NPV_{\text{op}} = \$1.792$$

$$NPV_{\text{ac}} = \$6.32$$

The inverse is now true. I'd rather be an accountant.

## 2.a.

Taste.

## 2.b.

Taste. (Key word, the physician only "believes" this is the case and does not have statistical evidence.)

## 2.c.

Statistical.

## 2.d.

Taste. (Again, this is belief. However, in this case, giving *more* attention to a group instead of less because of a discriminatory practice is not considered to be racist by the wider public. It is, under the strictest definition, racism, but I doubt people would complain about receiving extra attention from their doctor for free.)

## 3.a.

$$H = \frac{10}{10^2} = 0.1$$

## 3.b.

$$H = 9\left(\frac{1}{90}\right)^2 + \left(\frac{9}{10}\right)^2 = \frac{73}{90} = 0.8\overline{1}$$

Increases in H represent a decrease in competition.

## 3.c.

The largest value is 1; this occurs when market share is completely held by a single company. In other words, when there is a monopoly.

## 3.d.

In the case of the market with the 1 large firm and 9 smaller firms, a single firm taking an $11^{\text{th}}$ of the market share will increase competition. The value in this case is:

$$H = 9\left(\frac{1}{90} \cdot \frac{10}{11}\right)^2 + \left(\frac{9}{10} \cdot \frac{10}{11}\right)^2 + \left(\frac{1}{11}\right)^2 = \frac{739}{1089} \approx 0.6786042241...$$

...which is less than the previous value, thus having more competition.

## 3.e.

$$H = \lim_{n\to\infty} n\left(\frac{1}{n}\right)^2 = \lim_{n\to\infty} \frac{1}{n} = 0$$

## 4.a.

$$1 \cdot 6\text{yr} = q \cdot 10\text{yr} \to q = \frac{3}{5}$$

## 4.b.

$$B = 0.7 \cdot (70 - 20) - 0.6 \cdot (70 - 20) = 5$$
$$C = \$10,000$$
$$ICER = \frac{C}{B} = \$2,000$$

## 4.c.

$$QALY_{20} = 5 \rightarrow B_{20} = 5 \cdot \$5,000 = \$25,000 > \$10,000$$
$$QALY_{60} = 1 \rightarrow B_{60} = 1 \cdot \$5,000 = \$5,000 < \$10,000$$
$$QALY_{69} = 0.1 \rightarrow B_{69} = 0.1 \cdot \$5,000 = \$500 < \$10,000$$

At the cost of $\$10,000$, it is worth it for the 20-year-old but neither the 60 nor 69-year-old.

## 4.d.

$$\$25,000 > \$1,000$$
$$\$5,000 > \$1,000$$
$$\$500 < \$1,000$$

At the cost of $\$1,000$, it is worth it for the 20 and 60-year-old, but still not the 69-year-old.

## 5.a.

If a worker were to work any number of hours in the interval $(L_1, L_2]$, they could earn the same or more value for performing less work. They will always prefer that, and so all values of labor in that interval result in a utility which falls below other achievable input values of $L$.

## 5.b.

For *most* workers, it is less than.

## 5.c.

It would shrink. The higher point given by $L_1$ would fall, and thus the value of $L_2$ would meet the line at a point closer to $L_1$.

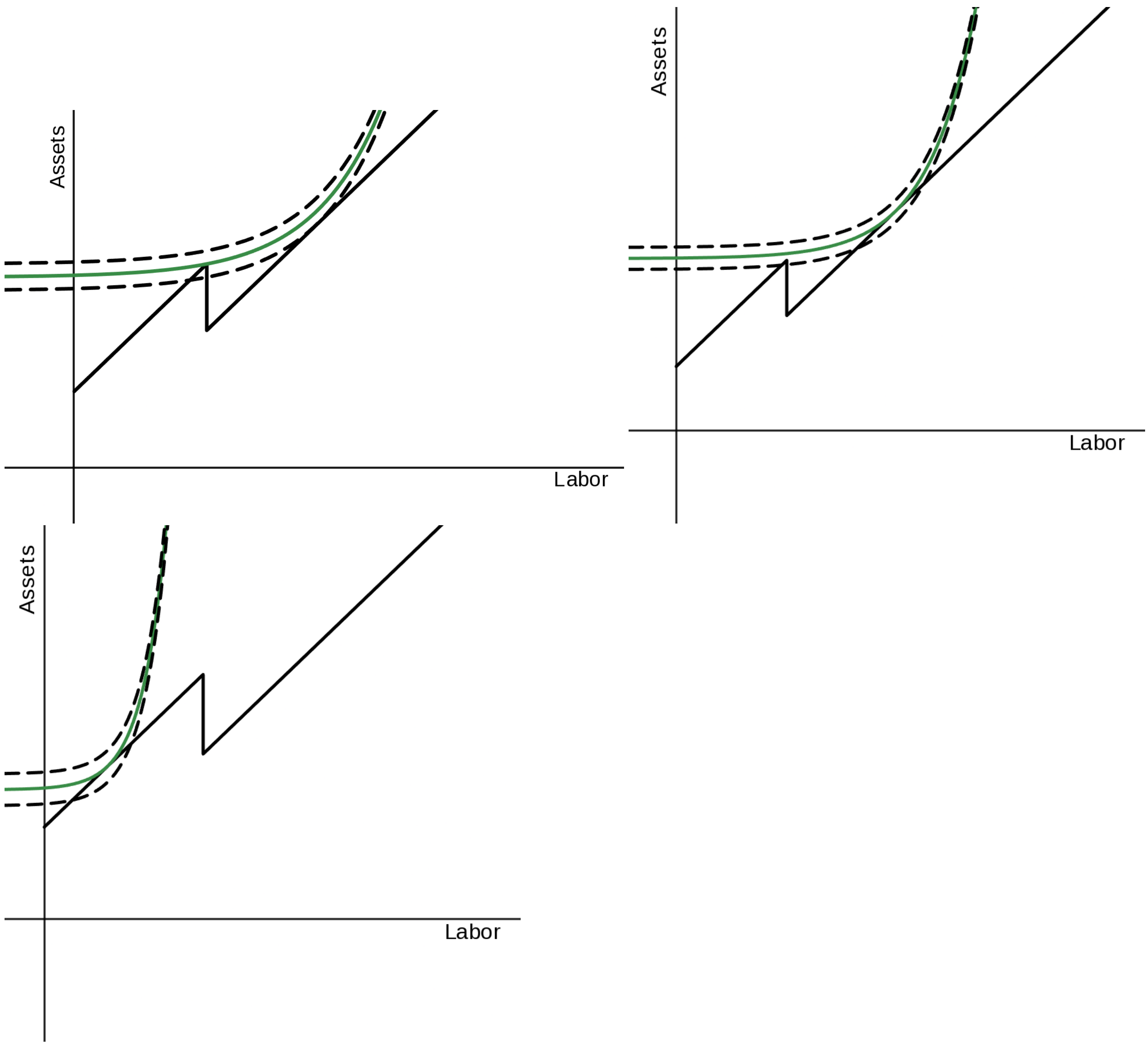
## 5.d.

As discussed in **5.a.**, The values at or below $L_1$ (at an equivalent value) are always preferable to any value given from labor in the interval $(L_1, L_2]$, which includes the value *at* $L_2$. This is because they could work less for the same value.

## 5.e.

It would expand the region. It is already the case that $(L_1, L_2]$ is unfavorable, but adding an extra inventive to that only adds to the pile. Take a point some small distance above $L_2$, say $L_2 + \varepsilon$; this value would have a higher return to utility from the pay gained from working, but it would also come with the marginal disutility of $\varepsilon$. The exact values of these will depend on some derivatives at the points, but in the end the disutility of $\varepsilon$ more units of labor will overpower the utility of extra income for small values of $\varepsilon$.

## 5.f.



## 5.g.

Any utility curve which meets the line at a point in the interval $(L_1, L_2]$ will pass through the line some place below the value $L_1$. This means that there must be some higher indifference curve which also meets the line.

## 5.h.

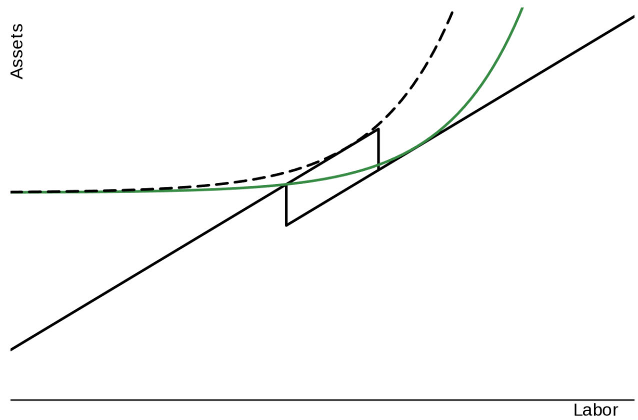



Figure 1: image

As we can see in this figure, the increase in the income threshold has incentivised workers at $L_1$ to work somewhere in the interval $(L_1, L_2)$.