Health Economics - Assignment 2

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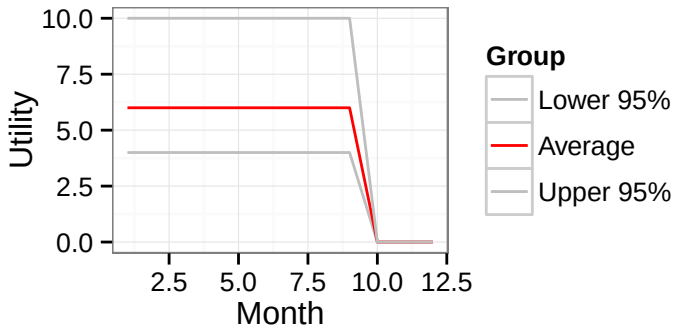
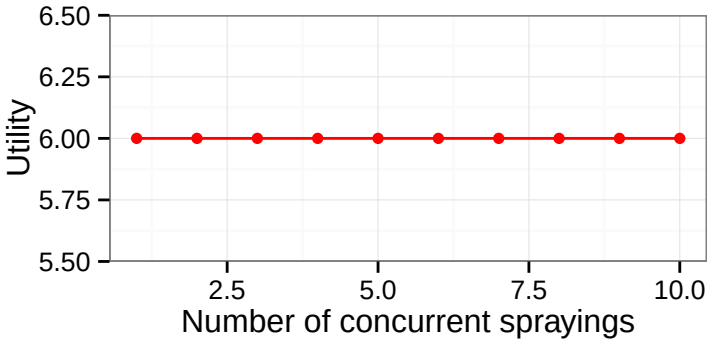
Question 1:
Assuming that the efficacy of indoor residual spraying (IRS) lasts maximum 9 months after the day of fumigation, make a numerical example and explain the total and marginal utility of receiving the intervention every year.

In order to make a numerical representation of the total and marginal utility related to IRS, we'll need to make multiple assumptions:

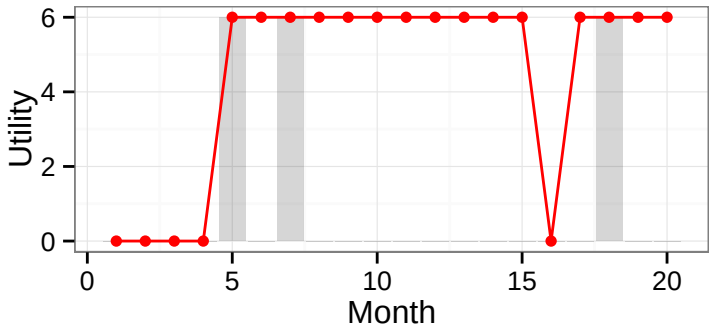
Assumption 1: That spraying's effects last a maximum of 9 months, and that the average population-level "utility" for the effects of spraying (displayed below) remains constant and flat during the period of effectivity.



Assumption 2: That there is no additive effect to utility - not to effect longevity - from multiple, concurrent sprayings. By the same token, we assume (perhaps unrealistically) that there is no negative effect from multiple sprayings.



Assumption 3: That the only potential gain in utility from multiple sprayings would be a function of time - that is, a non-concurrent overlapping spraying could extend the longevity of IRS' effect. The below chart, in which grey bars represent spraying and the red line represents utility, illustrates this. Note that the sequential sprayings at month 5 and 7 have no effect on utility, other than to extend the high utility out to 9 months after the latter (ie, month 16).



Having made these assumptions, we can construct the table. In the below case, we assume that IRS spraying is annual, and at the same time every year. We calculate house-specific "Marginal utility" and assume that the beneficiaries (ie, household numbers) remain constant in quanitity and character.

Year	Quantity IRS	Marginal utility	Total utility
1	1	6	6
2	1	6	12
3	1	6	18
4	1	6	24

In reality, given the long time frame for the above table, it's likely that the number of beneficiaries (ie, household members) would be variable in both quantity and character, thereby effect marginal utility. Here's a variation in which we assume, for example, that a pregnancy occurs in year 2, thereby increasing the marginal utility gained from IRS during year 2 and the subsequent years.

Year	Quantity IRS	Marginal utility	Total utility
1	1	6	6
2	1	10	16
3	1	10	26
4	1	10	36

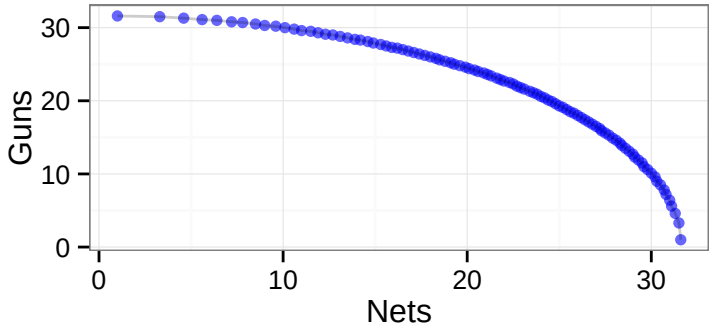
Question 2:
Depict the production possibility frontier using the Excel file attached. Name q1 and q2 and substitute the zeros of the two columns A and B (from row 2 to row 14) to automatically draw a graph representing a PPF. In columns C and D (to row 2 to row 14) substitute the zeros in order to draw another PPF that represents a technological improvement in comparison with the curve depicted from columns A and B. Then, briefly explain the graphs depicted.

For the purposes of depicting a production possibility frontier, I've chosen to use the classic Guns and better example. Below is a fictitious (and abbreviated) example:

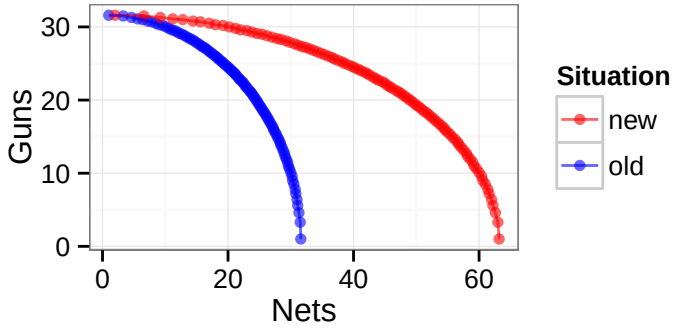
	Nets	Guns
1	1.0	31.6
11	10.1	30.0
21	14.2	28.3
31	17.4	26.4
41	20.1	24.4
51	22.5	22.3

	Nets	Guns
61	24.6	19.9
71	26.6	17.1
81	28.4	13.9
91	30.2	9.6

Below is a visualization of the above table.

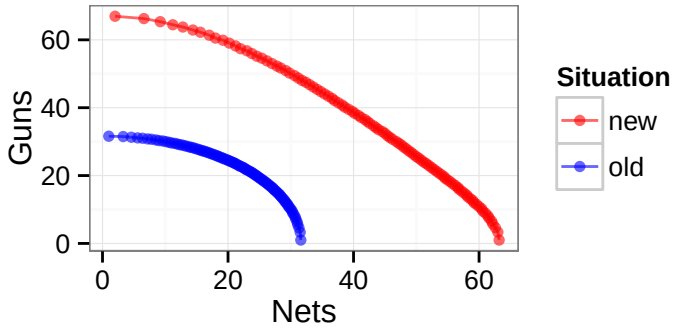


Technological innovation could could change the cost of production of either Guns or Nets. For example, if a mechanical Nets-churner were to double the productivity of Nets-makers, the curve would change dramatically.



Note that in the above chart that the curve has not simply shifted uniformly to the right. At X=0 (ie, no Nets), productivity has remained the same in both the old and new situations. This is because the technological innovation only affected Nets production, and not gun production.

If we were to assume an improvement in gun production, then the curve might look more like this. For the purposes of the below example, we'll assume a non-linear improvement in gun production, in which productivity has improved most at the small scale, but high marginal costs hampers productivity at the large scale.



Question 3:

In the graph representing demand and supply of bed Nets depict and describe what will happen if instead of producing q* (quantity of equilibrium) a lower quantity q*-10 would be produced.

In the above graphs, the quantity of equilibrium (QE) is a function of the cost (which we have invented) of each of the commodities, as well as the *price*. In this case, we'll assume that

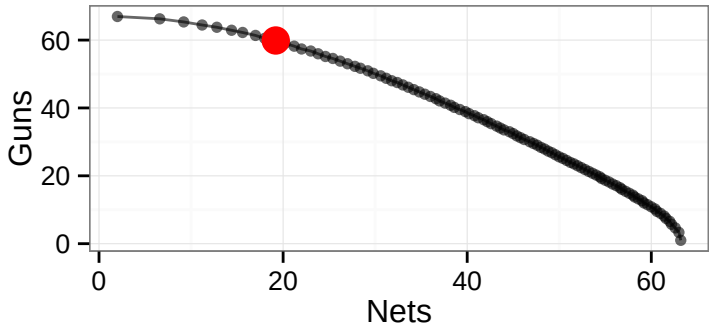
- A unit of Nets costs $1 to produce and sells at $3
- A unit of Guns costs $2.50 to produce and sells at $5

With these assumptions, we can calculate the Profit at each point of the curve

Guns	Nets	Profit
66.94946	2.0	171.3736
66.26050	6.6	178.8512
65.34830	9.2	181.7708
64.44586	11.2	183.5147
63.77854	12.8	185.0464
62.89346	14.4	186.0337

(The above table is abridged - the full table is in the appendix.)

We calculate equilibrium (ie, the point of greatest Profit) to be at a production of 19 units of Nets and 60 units of Guns.



Appendix

Full table from question number 3.

Guns	Nets	Profit
66.949456	2.0	171.3736
66.260496	6.6	178.8512
65.348300	9.2	181.7708
64.445864	11.2	183.5147
63.778542	12.8	185.0464
62.893464	14.4	186.0337
62.239637	15.6	186.7991
61.371619	17.0	187.4290
60.512945	18.0	187.2824
59.879798	19.2	188.0995
59.037733	20.2	187.9943
58.204767	21.2	187.9119
57.380815	22.0	187.4520
56.774939	23.0	187.9373
55.967002	23.8	187.5175
55.167844	24.6	187.1196
54.581342	25.4	187.2534
53.797774	26.2	186.8944
53.022752	27.0	186.5569
52.256198	27.8	186.2405
51.695250	28.4	186.0381
50.943726	29.2	185.7593
50.200448	29.8	185.1011
49.465336	30.6	184.8633
48.738315	31.2	184.2458
48.019307	31.8	183.6483
47.495706	32.4	183.5393
46.790913	33.0	182.9773
46.093923	33.6	182.4348
45.404662	34.2	181.9117
44.723057	34.8	181.4076
44.049036	35.4	180.9226
43.382528	36.0	180.4563
42.723461	36.6	180.0087
42.071764	37.0	179.1794
41.427369	37.6	178.7684
40.790205	38.2	178.3755
40.160205	38.6	177.6005
39.537301	39.2	177.2433
38.921424	39.8	176.9036
38.312508	40.2	176.1813
37.710488	40.8	175.8762
37.115297	41.2	175.1882
36.526870	41.8	174.9172
35.945144	42.2	174.2629
35.370053	42.6	173.6251
34.643516	43.2	173.0088
34.082858	43.6	172.4071

Guns	Nets	Profit
33.528636	44.0	171.8216
32.980790	44.6	171.6520
32.439258	45.0	171.0981
31.752634	45.4	170.1816
31.224844	45.8	169.6621
30.703177	46.2	169.1579
30.040114	46.8	168.7003
29.531780	47.2	168.2295
29.029384	47.6	167.7735
28.389196	48.0	166.9730
27.899736	48.4	166.5493
27.274840	48.8	165.7871
26.798049	49.2	165.3951
26.188139	49.6	164.6703
25.586216	50.0	163.9655
25.128529	50.4	163.6213
24.541131	50.8	162.9528
23.961475	51.2	162.3037
23.522289	51.6	162.0057
22.956708	52.0	161.3918
22.398633	52.4	160.7966
21.847981	52.8	160.2200
21.304672	53.2	159.6617
20.768625	53.6	159.1216
20.239761	54.0	158.5994
19.718001	54.4	158.0950
19.203267	54.6	157.2082
18.695480	55.0	156.7387
18.194564	55.4	156.2864
17.579826	55.8	155.5496
17.093468	56.2	155.1337
16.495223	56.6	154.4381
16.023080	56.8	153.6577
15.440944	57.2	153.0024
14.867229	57.6	152.3681
14.301828	58.0	151.7546
13.744636	58.2	150.7616
13.195547	58.6	150.1889
12.654455	59.0	149.6361
12.010739	59.2	148.4268
11.486276	59.6	147.9157
10.860859	60.0	147.1521
10.244862	60.4	146.4122
9.531376	60.6	145.0284
8.934685	61.0	144.3367
8.137036	61.4	143.1426
7.455784	61.6	141.8395
6.578448	62.0	140.4461
5.714604	62.2	138.6865
4.660812	62.6	136.8520
3.320669	63.0	134.3017
1.000000	63.2	128.9000