

STOR-i masterclass, Solutions Practical Session

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Question 1

The .mod and .run files can be found on the webpage.

Question 2

It depends on the machine, on my machine KNITRO finds 1093.96 and BARON finds 1093.96.

Question 3

The sum preserves convexity, so we can analyze each term of the summation separately. The terms $a + bx$ are an affine function, thus a linear function (both convex and concave). Term cx^2 is convex because $x \geq 0$ and $c > 0$. Finally, dx^3 is concave because $x \geq 0$ and $d < 0$. Thus, nothing can be said about the convexity of the objective function.

Question 4

The .mod and .run files can be found on the webpage.

It depends on the machine, on my machine KNITRO finds 4947470 and BARON finds 4975480.

The sum preserves convexity, so we can analyze each term of the summation separately. The terms $d + cx$ are an affine function, thus a linear function (both convex and concave). Term bx^2 is convex because $x \geq 0$ and $b > 0$. Finally, ax^3 is convex because $x \geq 0$ and $a > 0$. Thus, $\sum_j (d + cx + bx^2 + dx^3)$ is convex. However, we maximize the profit, thus minimizing a concave function. Also in this case the problem is not convex.

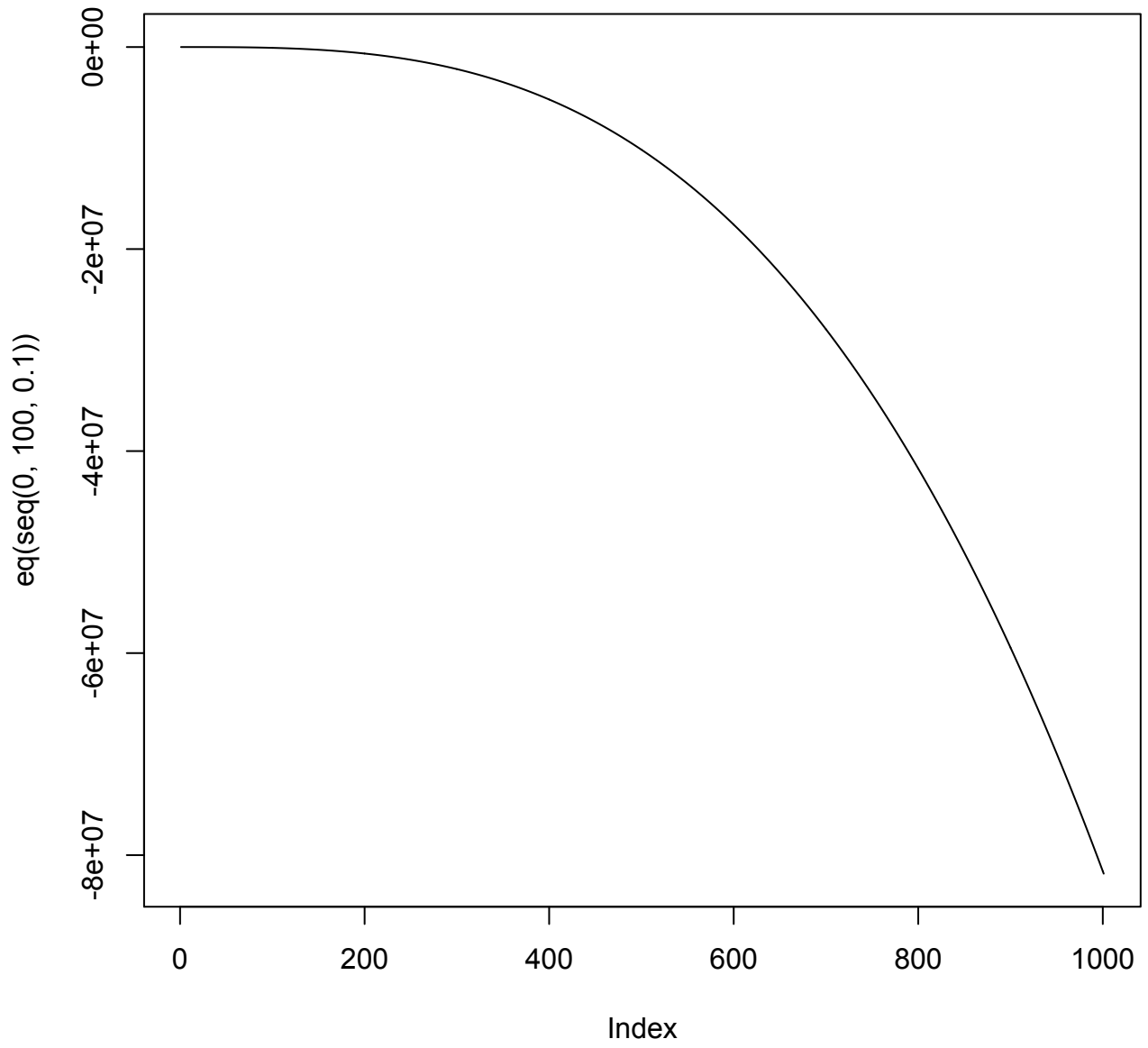


Figure 1: Plot of profit of Q1 for item 1

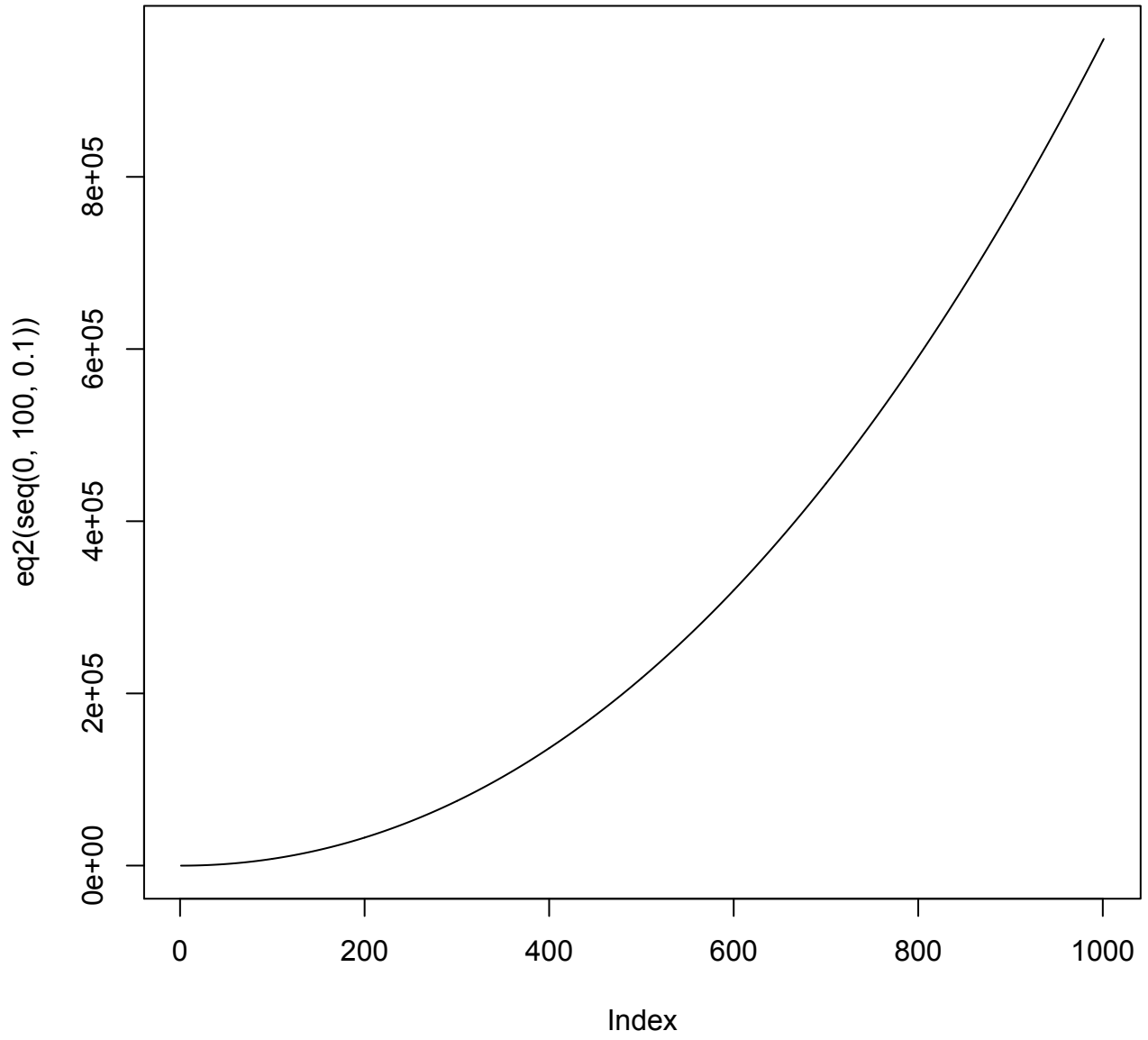


Figure 2: Plot of profit of Q4 for item 1

Question 5

The .mod and .run files can be found on the webpage.

It depends on the machine, on my machine KNITRO finds 267.226 and BARON finds 299.2468109 after its default time limit is reached. The sum preserves convexity, so we can analyze each term of the summation separately. Also positive scaling preserves convexity, thus we can focus on $(1 + b_j \exp^{-a_j(x+d_j)})^{-1}$. Function $1 + b_j \exp^{-a_j(x+d_j)}$ is convex, however raising to -1 is convex but not nondecreasing. Thus, convexity is not preserved.

Question 6

Exam 2013, 1a and 2a

The .mod and .run files can be found on the webpage.

Exam 2013, 1c

The MILP problem of point 2a is a restriction of the MINLP problem of point 1a (only a subset of the potential positions considered in point 1a is taken into account in point 2a).

Exam 2013, 2

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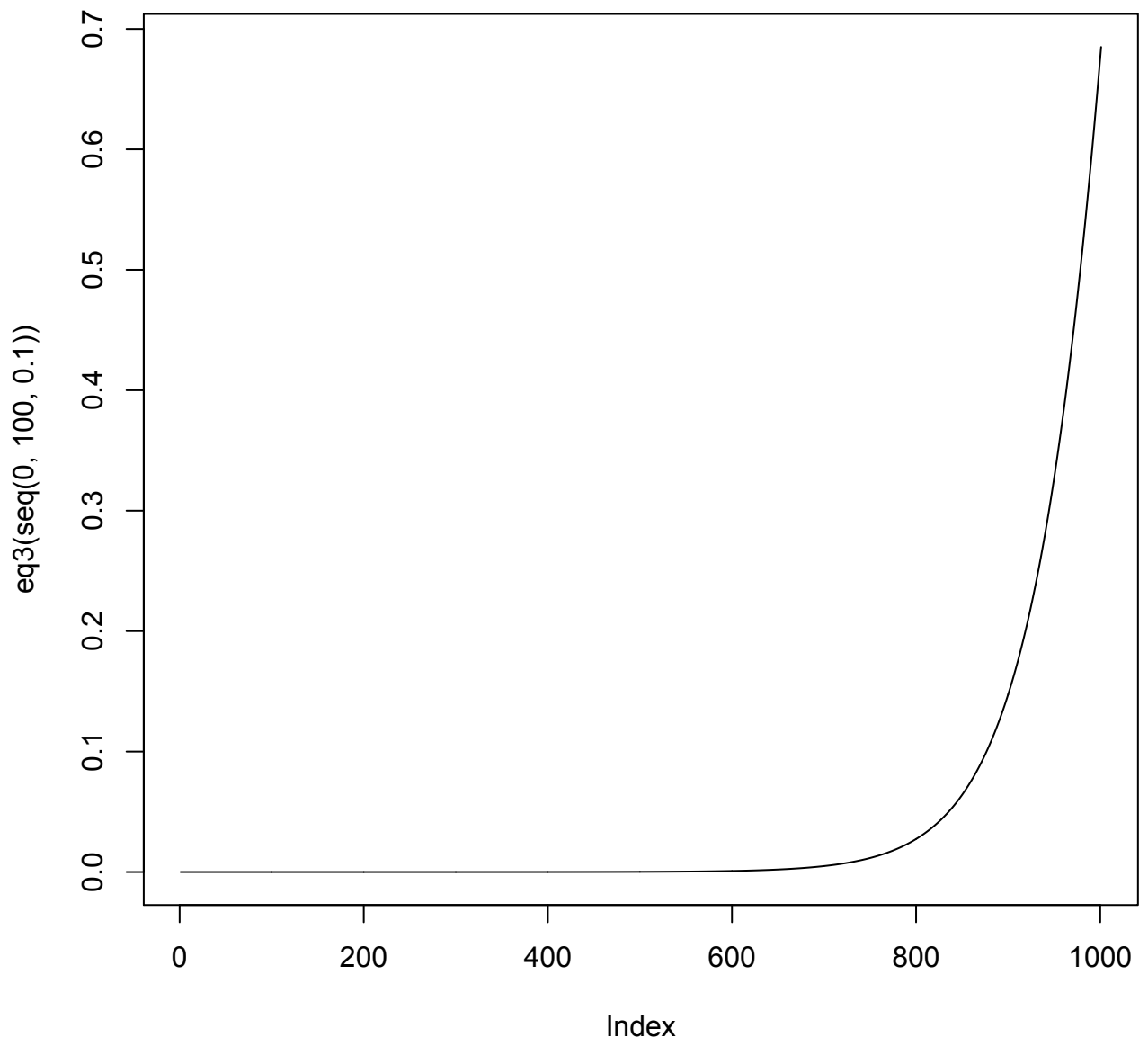


Figure 3: Plot of profit of Q5 for item 1