Homework 1

Matej Kalc

Exercise 5

		Circle	**Square**	**Triangle**
	$f(x_k) - f(x^*)$	0.02	0.02	0.02
	Boundary	5.40	5.40	5.40
	Guarantee satisfied	True	True	True
	$f(x_k) - f(x^*)$	0.01	0.01	0.01
	Boundary	0.62	0.62	0.62
	Guarantee satisfied	True	True	True
	$f(\sum_{i=1}^{T} \frac{2i}{T(T+1))x_i}) - f(x^*)$	0.01	0.02	0.03
	Boundary	38.23	38.23	38.23
	Guarantee satisfied	True	True	True

Table 1. Results of exercise 5 for three theorems: Theorem 3.3.2, 3.3.3 and 3.3.4 in the notes.

I tested PGD with three different settings for γ and three different domains (see Table 1). The best theorem for our function f is theorem 3.3.3, since it resulted in the most ac-curate approximation of the minimum and had the lowest boundary. Theorems 3.3.2 qnd 3.3.4 also resulted in a good approximation of the function minimum, but their guarantees are too large. PGD was tested with 10 steps.

Exercise 6

To complete the exercise first I calculated the derivatives. I performed 10000 steps with GD (results are shown in Table 2). I managed to get all the digits apart for the last one, which is probably rounded to 6.

Found x_k	(0.11461434 0.55564885 0.85254695)
Found minimum	-3.862782147820755
Real minimum	-3.86278214782076
Abs. difference	4.884981308350689e-15

Table 2. Results of exercise 6.