

**Math 527 - Homotopy Theory**  
**Spring 2013**  
**Homework 9, Lecture 3/13**

**Problem 2.** Show that a (strictly) commutative diagram

$$\begin{array}{ccc} W & \xrightarrow{f'} & Y \\ g' \downarrow & & \downarrow g \\ X & \xrightarrow{f} & Z \end{array}$$

is homotopy  $k$ -Cartesian if and only if for all  $x \in X$ , the induced map on homotopy fibers

$$f'' : F_x(g') \rightarrow F_{f(x)}(g)$$

over the respective basepoints  $x \in X$  and  $f(x) \in Z$  is  $k$ -connected. Here we have  $k \geq 0$  or  $k = \infty$ .