1. （30 分）

$$w = \frac{\sum_{i=1}^m y_i(x_i - \bar{x})}{\sum_{i=1}^m x_i^2 - \bar{x}\sum_{i=1}^m x_i}$$
$$= \frac{\sum_{i=1}^m (y_i x_i - y_i \bar{x})}{\sum_{i=1}^m (x_i^2 - x_i \bar{x})}$$

又因为 $\bar{y}\sum_{i=1}^m x_i = \bar{x}\sum_{i=1}^m y_i = \sum_{i=1}^m \bar{y}x_i = \sum_{i=1}^m \bar{x}y_i = m\bar{x}\bar{y} = \sum_{i=1}^m \bar{x}\bar{y}$, $\sum_{i=1}^m x_i \bar{x} = \bar{x}\sum_{i=1}^m x_i = \bar{x} \cdot m \cdot \frac{1}{m} \cdot \sum_{i=1}^m x_i = m\bar{x}^2 = \sum_{i=1}^m \bar{x}^2$, 则上式可化为：

$$w = \frac{\sum_{i=1}^m (y_i x_i - y_i \bar{x} - x_i \bar{y} + \bar{x}\bar{y})}{\sum_{i=1}^m (x_i^2 - x_i \bar{x} - x_i \bar{x} + \bar{x}^2)}$$
$$= \frac{\sum_{i=1}^m (x_i - \bar{x})(y_i - \bar{y})}{\sum_{i=1}^m (x_i - \bar{x})^2}$$

2. （40 分）

(1)使用最小二乘法，可得优化目标如下

$$L_1(w) = \sum_{i=1}^3 (y_i - wx_i)^2 = (0.9 - w)^2 + (0.1 - 0)^2 + (2.2 - 2w)^2$$

通过将导数设置为0，得到

$$\frac{\partial L_1(w)}{\partial w} = -2 * (0.9 - w) - 4 * (2.2 - 2w) = 0$$
$$w = 1.06$$

（2）使用最小二乘法，可得优化目标如下：

$$L_2(w) = \sum_{i=1}^3 (y_i - wx_i^2)^2 = (0.9 - w)^2 + (0.1 - 0)^2 + (2.2 - 4w)^2$$

对 w 求导后为 0，得到

$$\frac{\partial L_2(w)}{\partial w} = -2 * (0.9 - w) - 8 * (2.2 - 4w) = 0$$

解得

$$w = \frac{19.4}{34} \approx 0.57$$

3. （30 分）

y=-17.0594+0.0982x1-0.0881x2-0.0583x3-0.6069x4+0.1093x5+0.8926x6-0.3389x7+0.3755x8+0.0180x9+0.2913x10+0.0951x11+0.5189x12-1.7791

均方误差：

$$E\ (f;D) = \frac{1}{m}\sum_{i=1}^{m}(f(x_i) - y_i)^2 = 28.5206$$

错误率：