Homework set #1

1. Consider the following 150 sorted p-values:
   0.0003 0.0005 0.0009 0.0009 0.0012 0.0022 0.0025 0.0033 0.0035 0.0052
   0.0238 0.0263 0.0446 0.0470 0.0506 0.0564 0.0585 0.0660 0.0662 0.0685
   0.0805 0.0814 0.1084 0.1118 0.1217 0.1247 0.1288 0.1305 0.1447 0.1463
   0.1487 0.1541 0.1614 0.1896 0.1931 0.2181 0.2187 0.2218 0.2354 0.2389
   0.2485 0.2592 0.2976 0.3012 0.3050 0.3054 0.3122 0.3183 0.3202 0.3233
   0.3481 0.3491 0.3506 0.3543 0.3677 0.3738 0.3811 0.3872 0.3940 0.3992
   0.4033 0.4185 0.4240 0.4277 0.4361 0.4412 0.4436 0.4890 0.4894 0.4912
   0.4954 0.4972 0.5081 0.5193 0.5198 0.5199 0.5232 0.5254 0.5255 0.5290
   0.5292 0.5395 0.5397 0.5408 0.5444 0.5629 0.5638 0.5664 0.5767 0.5876
   0.5937 0.5960 0.6021 0.6203 0.6378 0.6396 0.6438 0.6513 0.6532 0.6671
   0.6857 0.6983 0.7085 0.7122 0.7302 0.7306 0.7426 0.7429 0.7454 0.7486
   0.7495 0.7534 0.7613 0.7633 0.7653 0.7681 0.7766 0.7806 0.7821 0.7828
   0.7866 0.7867 0.7870 0.7901 0.8039 0.8084 0.8116 0.8140 0.8159 0.8212
   0.8229 0.8304 0.8594 0.8698 0.8771 0.8874 0.8886 0.8973 0.9027 0.9043
   0.9066 0.9169 0.9208 0.9269 0.9330 0.9452 0.9454 0.9670 0.9781 0.9970

   (a) How many hypotheses would be rejected using without using any multiple test adjustment. How many would be rejected using Boinferroni adjustment?

   (b) How many hypotheses would be rejected using the step up and the step down method?

2. Define $\tilde{r} = \max_r\{p_{(k)} \leq \alpha k/m \text{ for all } k \leq r\}$. Proof that the step down procedure, $R = \{p_{(1)}, \ldots, p_{(\tilde{r})}\}$ satisfies the condition $SC(\alpha, 1/m.r)$.

3. (a) Assume that $\mathcal{H}_0 = \mathcal{H} \neq \emptyset$ and $\text{FDR}(R)) \leq \alpha$. What can you say about $P(\text{any correct hypothesis is rejected})$?

   (b) Assume that $\mathcal{H}_1 = \{h\}$, $\mathcal{H}_0 \neq \emptyset$ and $\text{FDR}(R)) \leq \alpha$. What can you say about $P(\text{any correct hypothesis is rejected})$?

4. Assume that $U \sim U(0,1)$, V is independent of U and $\beta(x) \leq x$. Prove or disprove: The dependency criterion $\text{DC}(\beta)$ is satisfied for (U, V).