1. Let $X$ be a single observation on a Poisson($\lambda$) model, $f(x; \lambda) = e^{-\lambda}\lambda^x/x!$ for $x \in \{0, 1, 2, \ldots\}$. For testing $H_0 : \lambda = 1$ versus $H_1 : \lambda = 3$, consider the rejection region $C = \{x : x \geq 4\}$. Encircle the best statement:
   (a) $C$ has Type I error probability 0.
   (b) This test is most powerful of its size.
   (c) Both of (a) and (b) are true.
   (d) Neither of (a) and (b) is true.
   (Explanations not necessary but if shown on separate paper will count for possible partial credit if needed.)

2. (Continuation). With loss 0 for a correct decision and 1 for an incorrect decision, the Bayes test for the above $H_0$ versus the above $H_1$ satisfies (encircle best answer):
   (a) The probability of an incorrect decision is minimized.
   (b) The test is most powerful of its size.
   (c) Both of (a) and (b) are true.
   (d) Neither of (a) and (b) is true.
   (Explanations not necessary but if shown on separate paper will count for possible partial credit if needed.)

3. (Continuation). Suppose that $X = 2$ is observed. Encircle the best statement:
   (a) The Type II error probability is $\sum_{x=0}^{3} e^{-3}3^x/x!$.
   (b) The $P$-value is $\sum_{x=2}^{\infty} (ex!)^{-1}$.
   (c) Both of (a) and (b) are true.
   (d) Neither of (a) and (b) is true.
   (Explanations not necessary but if shown on separate paper will count for possible partial credit if needed.)

4. Encircle the best statement:
   (a) The null hypothesis should be rejected if the $P$ value is larger than 0.5.
   (b) The $P$-value never exceeds the Type I error probability.
   (c) The $P$ value is a random variable.
   (d) None of (a), (b) and (c) is true.
   (Explanations not necessary but if shown on separate paper will count for possible partial credit if needed.)

5. Let $\bar{X}_1$ and $\bar{X}_2$ be sample means based on independent samples of sizes $n_1$ and $n_2$, respectively, from $N(\mu_1, 1)$ and $N(\mu_2, 1)$ populations. Consider testing $H_0 : \mu_1 = \mu_2$ versus $H_1 : \mu_1 \neq \mu_2$. Put $z = (\bar{X}_1 - \bar{X}_2)/(n_1^{-1} + n_2^{-1})^{1/2}$. The $P$-value is (encircle best answer):
   (a) $P(N(0, 1) > |z|)$
   (b) $P(N(0, 1) < -|z|)$
   (c) $2P(N(0, 1) > |z|)$
   (d) none of these
   (Explanations not necessary but if shown on separate paper will count for possible partial credit if needed.)