Algorithm 1: Single Point Fast HHG Test

input : (1) sample point matrix $X \in \mathbb{R}^p$ of size N, $Y \in \mathbb{R}^q$ of size M (2) single point $z_x \in \mathbb{R}^p$, $z_y \in \mathbb{R}^q$ (3) *test* = desired univariate independence test (4) *metric* = distance metric

output: test statistic T, dependent on chosen test, and p-value P

function T, P = `SINGLEPOINTTEST(`X, Y, z_x, z_y`)`
    for $iin1 : N$ **do** `/* compute distance-from-point matrix */`
        $D_x, D_y \leftarrow$ `POINTDISTANCE(`$X, Y, z_x, z_y, metric$`)`
        `/*` D_x `= 1D collection of distances of size N */`
        `/*` D_y `= 1D collection of distances of size M */`
    end
    if *test* = *Kolmogorov-Smirnov* **then**
        T, P = `KSTEST(`D_x, D_y`)`
    end
    else if *test* = *Cramer-Von Mises* **then**
        T, P = `CMTEST(`D_x, D_y`)`
    end
end

Algorithm 2: Point Distance Function

input : (1) sample point matrix $X \in \mathbb{R}^p$ of size N, $Y \in \mathbb{R}^q$ of size M (2) single point $z_x \in \mathbb{R}^p$, $z_y \in \mathbb{R}^q$ (3) Metric Type

output: 1D collection of distances D_x of size N and D_y of size M

function D_x, D_y = `POINTDISTANCE(`$X, Y, z_x, z_y, metric$`)`
    for *i in 1:N* **do**
        $D_x[i] \leftarrow D(X_i, z_x)$; `/* where D = valid distance metric */`
    end
    for *j in j:M* **do**
        $D_y[i] \leftarrow D(Y_i, z_y)$; `/* where D = valid distance metric */`
    end
end

Algorithm 3: Kolmogorov-Smirnov Test

input : (1) One-dimensional collection of distances D_x of length N and D_y of length M

output: test statistic T and p-value P

function T, P = `KSTEST`(D_x, D_y)
  T ← $supremum_x(|EDF_{D_x}(\mathrm{x})$ - $EDF_{D_y}(\mathrm{x})|$
  P ← Pr(K ≤ $\sqrt{\frac{N+M}{N \cdot M}} * T$) ; `/* K = Kolmogorov distribution */`
end

Algorithm 4: Cramer-Von Mises Test

input : (1) One-dimensional collection of distances D_x of length N and D_y of length M

output: test statistic T and p-value P

function T, P = `CMTEST`(D_x, D_y)
  RD_x ← D_x arranged in increasing order
  RD_y ← D_y arranged in increasing order
  RD_xy ← Combined sample of D_x and D_y in ranked order
  Let $r_1, r_2, ..., r_N$ be ranks of D_x elements in RD_xy
  Let $s_1, s_2, ..., s_M$ be ranks of D_y elements in RD_xy
  U ← $N \sum_{i=1}^{N} (r_i - i)^2 + M \sum_{j=1}^{M} (s_j - j)^2$
  T ← $\frac{U}{NM(N+M)} - \frac{4MN-1}{6(M+N)}$
  P ← approximated from limiting distribution of test statistic
end