5.11 Given $R_0 = \{01101111\}$ and $R_1 = \{00110001\}$: When using ones count testing, we obtain $OC(R_0) = 6$ and $OC(R_1) = 3$. Because $OC(R_0) \neq OC(R_1)$, this fault can be detected. The aliasing probability is:

$$P_{OC}(6) = \frac{C(8, 6) - 1}{2^8 - 1} = \frac{27}{255} = 0.11$$

When using transition count testing, we obtain $TC(R_0) = 3$ and $TC(R_1) = 3$. Because $TC(R_0) = TC(R_1)$, this fault cannot be detected. The aliasing probability is:

$$P_{TC}(3) = \frac{2C(7, 3) - 1}{2^8 - 1} = \frac{69}{255} = 0.27$$

5.12 Given $f(x) = 1 + x + x^4$ and $M = \{10011011\}$, we obtain the fault-free signature $R = \{1011\}$. For the faulty sequence $M' = \{11111111\}$ or $M'(x) = 1 + x + x^2 + x^3 + x^4 + x^5 + x^6 + x^7$, by polynomial division $M'(x) = q'(x)f(x) + r'(x)$, we can obtain $q'(x) = x + x^2 + x^3$, and $r'(x) = 1 + x^2 + x^3$. Thus, the faulty signature $R' = \{1011\}$. Since $R = R$, the fault is undetected.

Another solution can be deduced by using error sequence $E$ where $E = M + M' = \{01100100\}$ or $E(x) = x + x^2 + x^5$. By polynomial division, we obtain $E(x) = xf(x)$. Since $f(x)$ divides $E(x)$, this fault is undetected.

5.13 Given $M_0' = \{00010\}, M_1' = \{00010\}, M_2' = \{11100\}, and M_3' = \{10000\}$. By $M(x) = M_0'(x) + xM_1'(x) + x^2M_2'(x) + x^3M_3'(x)$, we have $M = \{00110000\}$ or $M(x) = x^2 + x^3$. The faulty signature $R' = \{1011\}$, for $M = \{10011011\}$ and fault-free signature $R = \{1011\}$, because $R' \neq R$, this fault is detected.

5.16 (1) Before inserting test point: For the stuck-at-0 fault present at $X_3$, all inputs of the AND gate, $X_1$, $X_2$, $X_3$, $X_4$, $X_5$ and $X_6$, need to be 1. We need a 1 at $X_3$ to activate the stuck-at-0 fault and a 1 for each other input to propagate the faults. So the detection probability of a stuck-at-0 fault at $X_3$ is $1/64 (= 1/2 * 1/2 * 1/2 * 1/2 * 1/2 * 1/2)$.

For the stuck-at-1 fault present at $X_6$, input $X_6$ needs to be 0 to activate the fault, and all other inputs of the AND gate, $X_1$, $X_2$, $X_3$, $X_4$, and $X_5$, must be set to 1 to propagate the fault. So the detection probability of stuck-at-one fault at $X_6$ is $1/64 (= 1/2 * 1/2 * 1/2 * 1/2 * 1/2 * 1/2)$.

(2) After inserting test point:
For the stuck-at-0 fault present at $X_3$, input $X_3$ needs to be 1 to activate the fault. Inputs $X_1$ and $X_2$ need to be 1 and the control point needs to be 0 to propagate the fault. So the detection probability of the stuck-at-0 fault at $X_3$ is $1/16 (= 1/2 * 1/2 * 1/2 * 1/2)$.

For the stuck-at-1 fault present at $X_6$, input $X_6$ needs to be 0 to activate the fault. Assume that another input of the OR gate (with control point) is $A$, and the OR gate output is $B$. To propagate the stuck-at-1 at $X_6$, inputs $X_4$, $X_5$, and $B$ must to set to 1. Thus, either $A$ or the control point need to be 1. The probability of 1 at $B$ is $9/16 (=1- 7/8*1/2)$. So the detection probability of the stuck-at-one fault at $X_6$ is $9/128 (= 9/16 * 1/2 * 1/2 * 1/2)$. 


5.18 Aligned skewed-load in capture:

Aligned double-capture - I:
5.19 Staggered skewed-load:

Staggered double-capture: