Solutions to Exercises 2.

$$P(D \mid NS) = \frac{P(D \cap NS)}{P(NS)} = \frac{120}{120 + 444} = 0.213$$

So 21.3% of people with NS employment status default, 78.7% are OK.

Again if we reject everybody with NS employment the defaulting rate will be:

$$P(D \mid S) = \frac{P(D \cap S)}{P(S)} = \frac{270}{270 + 9324} = 0.0281 \quad \text{about the same as with the other}$$
criterion

If reject all that are NS then reject $\frac{564}{10158} = 0.0555$ about 5.6% of applications are rejected.

$$P(\bar{D} \mid NS) = 1 - P(D \mid NS) = 0.787$$

So still the vast majority of applications that are rejected would have been OK

If the use the criterion they will accept 0.9445 of the applications.

0.028 of these will default - lose 10000 0.972 will gain 2000

So money made = (0.972*2000-0.028*10000)*0.9445*N=1571.65 * N

This is better than not using the info.

Using the two tests.

Grant if pass both

$$P(D \mid (G \cap S)) = \frac{P(D \cap G \cap S)}{P(G \cap S)} = \frac{243}{243 + 8748} = 0.027$$

This is only a tiny bit less than using one test (either) !

$$P(\bar{D} \mid reject) = P(\bar{D} \mid (P \cup NS)) =$$
$$\frac{P(\bar{D} \cap (P \cup NS))}{P(P \cup NS)} = \frac{432 + 576 + 12}{108 + 432 + 27 + 576 + 12 + 12} = \frac{1020}{1167} = 0.874$$

87.4% of rejected applications would be OK.

Grant if pass either

$$P(passeither) = P(G \cup S)$$

$$P(D \mid (G \cup S)) = \frac{P(D \cap (G \cup S))}{P(G \cup S)} = \frac{390 - 108}{10158 - 108 - 432} = 0.029$$

As an alternative way of calculating these probs.

$$P(\bar{D} \mid reject) = P(\bar{D} \mid (P \cap NS)) = \frac{432}{432 + 108} = 0.8$$

Really applying two tests is no different to applying either – the second test is useless!
Both tests carry similar information.
This suggests they are not independent. (even conditionally)

$$P(P) = 0.1125 \text{ from page 2.}$$

$$P(P \mid S) = \frac{P(P \cap S)}{P(S)} = \frac{27 + 576}{27 + 576 + 243 + 8748} = 0.06285$$

As these are not equal the events are not indpedent.

Note I could have used G and/or NS instead of P and S.