1. (a) The labor demand curve may be derived by setting $MPN = w$. Here

$$MPN = 9 (25)^{0.5} (0.5) N_d^{-0.5}$$

Then, labor demand curve [remember that the labor demand curve has wages $w$ on the vertical axis] is given by

$$w = \frac{(4.5)(5)}{N_d^{0.5}} = \frac{22.5}{N_d^{0.5}} \quad (1)$$

The labor supply curve is given to you [remember that the labor supply curve has after-tax wages $(1 - t)w$ on the vertical axis] and so,

$$N_s = 100[(1 - t)w]^2 \Rightarrow [(1 - t)w] = \left( \frac{N_s}{100} \right)^{0.5}$$

(b) labor supply falls; check

$$\frac{dN_s}{dt} = 200[(1 - t)w](-w) < 0$$

(c) When $t = 0$, 

$$N_s = 100w^2$$

and [from (1)],

$$N_d = \left( \frac{22.5}{w} \right)^2$$

Equating, we get

$$100w^2 = \left( \frac{22.5}{w} \right)^2 \Rightarrow w^* = 1.5$$

i. $w^* = 1.5$

ii. $N^* = 225$

iii. labor income of all workers = $(1 - t)w^* N^* = 337.5$

(d) A simple way to answer this question would be to rework part (c) above with a higher value of $A$ (say $A = 10$) and then see if labor income of all workers went up or not. Alternatively, you could note that

$$MPN = A (25)^{0.5} (0.5) N_d^{-0.5}$$

implying that the labor demand curve is given by

$$w = \frac{(0.5A)(5)}{N_d^{0.5}} = \frac{2.5A}{N_d^{0.5}}$$

The labor supply curve is unchanged. Solve for the new $w^*$ and $N^*$ and see if the product of the new $w^*$ and $N^*$ is higher than 337.5 (see part c, iii) when $A > 9$. 

(e) With $t = 0.6$, you can basically rework part (c) and check that

i. market-clearing real wage is now 2.37
ii. employment is 90
iii. after-tax labor income of all workers is 85.38

(f) Because labor supply fell when the tax rate went up [why? read about income and substitution effects; an increase in the tax rate reduces after-tax wage]; as a result, the market-clearing wage went up, and consistent with that is that firms cut down on hiring.

(g) No. A minimum wage of 2 does not bind since employers are willing to pay a higher wage to begin with.

(h) With $t = 0$ and $w_{\text{min}} = 2$, the wage is 2, $N_s = 400$, $N_d = 126.6$, and so there is unemployment of 273.4. Total labor income is 253.2 lower than part c iii.

(a) a l-s tax does not change the real wage; it only reduces the worker’s wealth; hence there is only an income effect on labor supply.

(b) If $T = 35$, $NS = 92 + 12w$. Labor demand is given by $ND = 154.5 - \frac{w}{2}$ [use $w = MPN$ and solve for $ND$ to get this]. Then set $NS = ND$ to get $w = 5$, $N = 152$.

(c) Since equilibrium real wage is less than 7, the min wage is binding. With the minimum wage, $w = 7$ and then $ND = 151$ and $NS = 176$. Hence, there will be unemployment.