Assignment 2

Question 1 (8 marks)

1) (2 marks)

   $\{E, H\}$ or $\{A, B, H\}$ or $\{B, D, H\}$ or $\{C, D, H\}$

   Let $X = \{A, B, C, D, E, G, H\}$,

   A can be removed because $\{B, C, D, E, G, H\}^+ = R$, so $X = \{B, C, D, E, G, H\}$;

   B can be removed because $\{C, D, E, G, H\}^+ = R$, so $X = \{C, D, E, G, H\}$;

   C can be removed because $\{D, E, G, H\}^+ = R$, so $X = \{D, E, G, H\}$;

   D can be removed because $\{E, G, H\}^+ = R$, so $X = \{E, G, H\}$;

   E cannot be removed because $\{G, H\}^+ = \{G, H\} \neq R$;

   G can be removed because $\{E, H\}^+ = R$, so $X = \{E, H\}$;

   H cannot be removed because $\{E\}^+ = \{A, B, C, D, E, G\} \neq R$.

   Thus, $\{E, H\}$ is a candidate key for R.

2) (2 marks)

   1NF. Non-prime attribute G is functionally determined by D.

3) (2 marks)

   No.

Decomposition	A	B	C	D	E	G	H
$R_1(A, B, C, D)$	a	a	a	**a**	b	b	b
$R_2(D, E, G, H)$	b	b	b	**a**	a	a	a

Decomposition	A	B	C	D	E	G	H
$R_1(A, B, C, D)$	a	a	a	a	b	a	b
$R_2(D, E, G, H)$	a	b	b	a	a	a	a

4) (2 marks)

   For $= \{AB \rightarrow CD, E \rightarrow D, ABC \rightarrow DE, E \rightarrow AB, D \rightarrow AG, ACD \rightarrow BE\}$:

Consider $AB \rightarrow CD$, AB is not a superkey, split R into $R_1\{A, B, C, D\}$ and $R_2\{A, B, E, G, H\}$

Consider $D \rightarrow A$ in $R_1\{A, B, C, D\}$, D is not a superkey, split R_1 into $\boldsymbol{R_{11}\{A, D\}}$ and $\boldsymbol{R_{12}\{B, C, D\}}$

Consider $E \rightarrow AB$, E is not a superkey, split R_2 into $\boldsymbol{R_2\{A, B, E\}}$ and $R_3\{E, G, H\}$

Consider $E \rightarrow G$, E is not a superkey, split R_3 into $\boldsymbol{R_{31}\{E, G\}}$ and $\boldsymbol{R_{32}\{E, H\}}$

One of the possible lossless-join decompositions to BCNF is: $R_{11}, R_{12}, R_2, R_{31}, R_{32}$