Question 1: 4 Points

Identify the propositions, and show their relations:

(a) *If you are happy and watch movies then your friend becomes unhappy.*

(b) *You are a Bangladeshi or if you are not a Bangladeshi then your friend is European.*

Question 2: 4 Points

Use a series of logical equivalences to identify if the compound proposition $(p \wedge (p \rightarrow q)) \rightarrow q$ is a tautology/contradiction/contingency.

Question 3: 6 Points

Construct the Truth Table for the compound proposition defined as $(\neg q) \rightarrow (p \lor \neg r)$

Question 4: 4 Points

Apply a series of logical equivalences to show that: $((\neg p) \rightarrow (r \lor q)) \equiv ((\neg r) \rightarrow ((\neg p) \rightarrow q))$ are logically equivalent.

Question 5: 5 Points

Determine if the below statements are True or False. Justify your answers with example or counter example.

(a) $\exists x(P(x) : x^5 = -1), x \in \mathbb{Z}$

(b) $\exists x(P(x) : x^6 < x^2), x \in \mathbb{R}$

(c) $\forall x(P(x) : 1000x > x), x \in \mathbb{R}$

(d) $\forall x(P(x) : (-x)^4 = x^4), x \in \mathbb{R}$